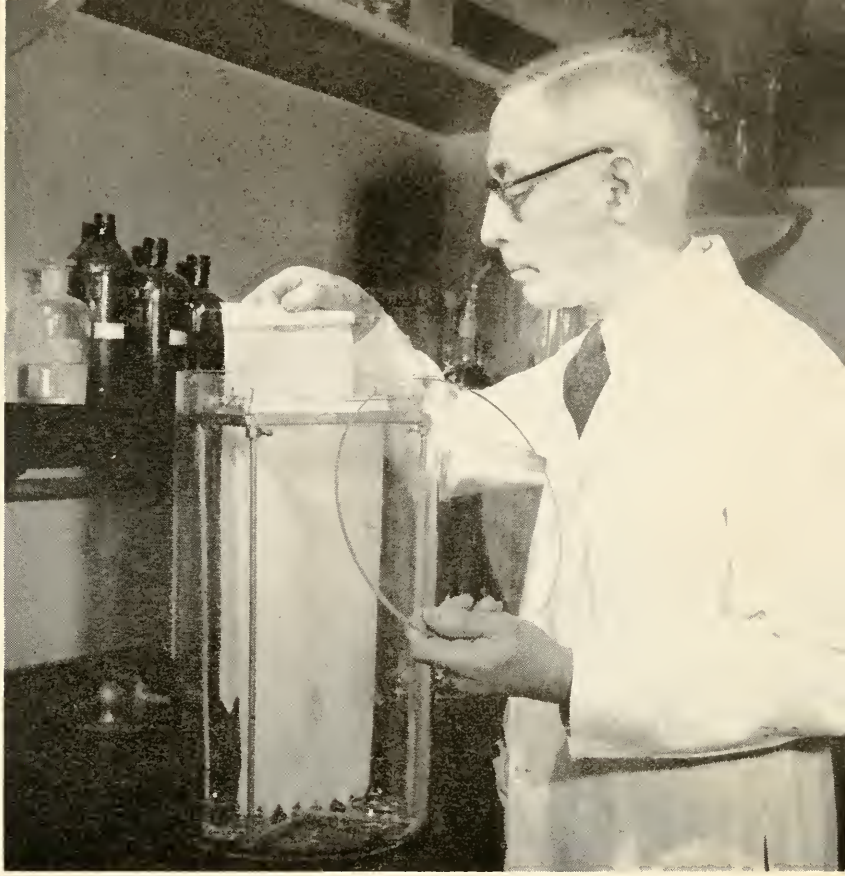
SHOUT
SHARE
IT

Station
Bulletin
402

June
1953



Report of the Director

OF THE

New Hampshire Agricultural Experiment Station

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

Foreword

This publication presents the 64th annual report of the Director of the Agricultural Experiment Station of the University of New Hampshire, and is a summary of the results on some eighty projects for the period July 1, 1951, to June 30, 1952. The brief individual project summaries were prepared by the respective project leaders. The material presented herein is organized by departments and not specifically by subject matter.

The introduction of new projects and the termination of old ones are constantly taking place. A special effort is made to serve the agricultural interests of the state through both fundamental and applied research. With the limited funds available it has not been possible to respond to all requests for specific research or to meet all the needs of agriculture. We try, however, to use all our resources effectively and efficiently.

Our research workers are informed about agricultural problems through their frequent contacts with farmers. Moreover, in meeting with other professional people and through the services rendered by the Office of Experiment Stations, they become acquainted with the results of research throughout the country. It is neither necessary nor feasible to duplicate much of the work done at other stations, except as the results are not applicable under New Hampshire conditions. Costs of research have increased greatly, thus making it all the more necessary to select only the most important problems for investigation.

Beginning in July, 1954, the Experiment Station proposes to publish quarterly the results of its research in a popular form. The reports will be given general distribution and should keep farmers well informed currently as to the progress of the Agricultural Experiment Station's research progress.

Harold C. Grinnell
Director

Mathias C. Richards
Associate Director

COVER

Pictured on the cover is Dr. Thomas G. Phillips, Chairman of the Department of Agricultural and Biological Chemistry, operating a paper chromotograph. This apparatus is used to study the changes which occur in grasses in silage. Information obtained from these investigations is of importance to the dairymen of New Hampshire.

Report of the Director

OF THE

New Hampshire Agricultural Experiment Station

July 1, 1951 -- June 30, 1952

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

Contents

Page

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

A New Fluorometric Determination of Thiamine 5
Starch Hydrolysis in Winter Squash 5
Factors Influencing the Vitamin C Value for Strawberries and Tomatoes 5
The Lasting Effect of Minor Elements and the Depressing Effect of Lime on Yield of Oats 6
Preservation of Carotene in Legumes and Grasses 6
Other Active Projects 6

AGRICULTURAL ECONOMICS

New Hampshire's Idle Farm Land 6
The Economics of Dairy Herd Replacements 8
Management Problems in the Use of Mow Hay Driers 9
Efficiency Measures for Milk Distribution 9
Handling Purchased Grain at the Farm 10
Management Adjustments in Potato Production 10
Consumer Habits of Purchasing, Using, and Storing Apples 12
Commercial Cucumber Growing 13
Marketing Poultry Meat 13
Handling and Merchandising Locally-Grown Vegetables 14
Other Active Projects 14

AGRICULTURAL ENGINEERING

Crooked Toes in Poultry May Result from Cold Floors 15
Other Active Projects 15

AGRONOMY

Hybrid Corn in New Hampshire 15
Disease-Resistant Oats for New Hampshire 16
New Potato Variety Popular with Both Consumer and Producer 16
Breeding for Better Legumes and Grasses 16
Too Little or Too Much Boron for Potatoes? 17
Ladino Clover Needs Both Lime and Potash 17
Irrigation Results in Better Quality Forage 18
The Use of Drainage Ditches 18
Alfalfa and Birdsfoot Trefoil Better Than Ladino Clover on Droughty Soil 19
Soil Survey 19
2,4-D Will Control Weeds in Corn that Is 12-18 Inches High 19
Other Active Projects 19

BACTERIOLOGY

Studies on Bovine Mastitis 20
Other Active Projects 20

BOTANY

Tomatoes Resistant to Late Blight 20
New Organic Fungicides Give Good Control of Apple Scab and Excellent Fruit Finish 20
Composting Aided by Hen Manure and Green Vegetation 20
Native Blackberries of New Hampshire 21
New Plant Diseases in New Hampshire 21
Other Active Projects 21

DAIRY HUSBANDRY

Persistency of Milk Yield Is Influenced by Certain Factors 22
Sex Ratio in Dairy Cattle Is Not Influenced by Normal Herd Management Practices 22
The Vitamin D Content of Forage Varies Greatly 22
Sulphur Dioxide Excells Molasses as a Silage Preservative 23
Digestibility and Utilization of Protein in Mow-Cured Hay Superior to That of Field-Cured Hay 23
Too Much Limestone Lowers Digestibility of Both Protein and Energy in Silage 24
Influence of the Ration on Vitamin Synthesis in the Rumen 24
Does Sulfur Dioxide Affect Vitamin Synthesis in the Rumen? 24
Rumen Microorganisms 25
Dairy Heifers Make Greater Gain on Grass Silage 25
How Does the Cow Use Sulfur from Sulfur Dioxide Silage 25
Minor Element Content of Forage Can Be Reduced by Heavy Fertilization 26
A Container for Carrying Bull Semen 27
Other Active Projects 27

ENTOMOLOGY

Search for Synergists Continues 27
Field Tests with Newer Insecticides 27
Spruce Insects 28
Distribution of Blood-Sucking Diptera and Tricoptera 28
Other Active Projects 28

FORESTRY

Tree Thinning with Chemicals 28
Other Active Projects 29

HORTICULTURE

Varieties of Tree Fruits That Hold the Spotlight 29
Fruits for Northern New Hampshire Are in Prospect 30
Grape Vines Should Be in Every Home Garden 30
Pear Breeding 31
Late-Ripening Strawberries Selected 31
Grape Breeding 31
Peach Breeding 31
Rubus Breeding 31
A New Strawberry Variety 32
Sawdust Added to Soil Has Not Increased Yields 32
Mowing Orchard Cover Conserves Moisture 32
Deer Damage 32
Durham Raspberry Culture 32
High Ascorbic Acid Tomatoes 33
Carrot Breeding 33
Sweeter Table Beets 33
Breeding Snap Beans 33
Chinese Cabbage, Cabbage, and Rutabaga Combined 33
Phosphorus Needed for Quality Lettuce 34
Beneficial Effects of Hay Mulch 34
Radioactive Phosphorus Is a Tool for Testing Uptake of Phosphorus Fertilizer by Apple Trees 34

Storage of Butternut Squash 35
Frozen Blueberries Vary in Quality 35
Fertilizers for Blueberries 35
Dusting Lowbush Blueberries 36
Weed Control in Blueberry Fields 36
Aluminum Wrappers Reflect Heat in Apple Trees 36
Rootstocks for Apple Trees 36
A New Pot Plant for Florists 36
New Hardy Rambler Roses for All of New Hampshire 37
Inbred Gladiolus 37
Low Stature Lilac for Home Planting 37
Improved Hazel Production 38
Korean Chestnuts Prove Hardy and Fruitful 38

POULTRY HUSBANDRY

Methionine May Improve Feed Efficiency 38
High Efficiency Feeds Satisfactory for Breeders 39
How Much Protein for Egg Production with Meat-Type New Hampshires? 39
Restricted Feeding on Range May Not Be Best Practice 40
Breeding for Meat and Eggs in the Same Bird 40
The Value of Crossing Strains of New Hampshires for Broiler Production 41
Problems Involved in the Vaccination of Infectious Bronchitis 41
Is It Possible for Chicks Under Four Weeks to be Vaccinated by the Wing Web Modified Live Virus Newcastle Vaccine? 42
Artificial Light Delays Pullet Maturity 42
Abnormal (Bulging) Eye in New Hampshires 43
The Effect of Frequency of Gathering Eggs from the Nest on Hatchability 43
Intensity of Artificial Illumination and Its Effect Upon Production in Meat-Type New Hampshires 44
Other Active Projects 44

STATE SERVICES

Seed Inspection 44
Inspection of Commercial Fertilizers — 1951 45
Inspection of Commercial Feedingstuffs 1951-52 45
Soil Testing 45
The National Poultry Improvement Plan 46
Diagnostic Services Performed at the Poultry Laboratory 46
Pullorum Testing 46
Infectious Bronchitis Virus 46
Differential Diagnosis of Newcastle Disease 46

ADDENDA

Publications 48
Changes in Personnel 48
Agricultural Experiment Station Staff 52
Financial Statement 52

Agricultural and Biological Chemistry

A New Fluorometric Determination of Thiamine.

The reaction between cyanogen bromide and thiamine is the basis for a new, simple, and rapid fluorometric determination of this vitamin. The method has a relatively high degree of sensitivity and specificity, and results compare favorably with the microbiological assay.

A. E. Teeri, D. Josselyn

Starch Hydrolysis in Winter Squash.

A highly active phosphorylase in the fiber of the fruit of Blue Hubbard squash has been obtained in a solution free from other enzymes affecting starch. This enzyme forms and breaks down the straight chain type of starch molecule (amylose).

A branching enzyme, which forms the amylopectin type of starch, has been separated from the phosphorylase. It has not been possible to free this enzyme entirely from the small amount of amylose which is also present.

T. G. Phillips

Factors Influencing the Vitamin C Value for Strawberries and Tomatoes.

Studies upon certain components of strawberries and tomatoes indicate it is inadvisable to place too much reliance upon published values for the vitamin C (ascorbic acid) content of these foods. Some sugars and naturally occuring organic acids interfere with the method commonly used for determining this vitamin (reaction of ascorbic acid with 2,6-dichlorophenol-indophenol). It is probable that to date, no true ascorbic acid values are found in literature for fruits and vegetables containing considerable sugar or dicarboxylic acids. Fresh strawberries contain large amounts of both of these groups of compounds. Their apparent vitamin C value, as determined by the dye reaction method, can be affected by variations in content of these components. When these berries are preserved by freezing, either with or without addition of sugar, changes in composition of the constituents other than ascorbic acid occur during the freezing and holding periods, again resulting in changes of apparent vitamin C content as determined by the aforementioned method.

Also, no true values are available for foods containing an enzyme system capable of destroying ascorbic acid. The existence of such an enzyme system has been known for some time, but its actual occurrence has not been shown in very many common foods. Because of some side studies in connection with this project, we are reasonably sure such an enzyme can exist in certain tomatoes — a food commonly relied upon for furnishing nutritional needs for ascorbic acid.

It seems apparent that much work must yet be done to rectify ascorbic acid values for foods in which either the enzyme system is present, or sugars and organic acids make up a considerable portion of the total composition, before the nutritive value of these foods can actually be stated.

H. P. Shimer, S. R. Shimer

The Lasting Effect of Minor Elements and the Depressing Effect of Lime on Yield of Oats.

Samples of timothy were taken for chemical analysis from Paxton soil in Center Strafford. Five years ago these plots were treated with two and five pounds of cobalt per acre as well as with various amounts of fertilizers. The results may be expected to show the lasting effects of these applications.

Soil samples and plant samples were taken from another series of plots in Northwood. These plots had been seeded to grasses and clovers at high and low rates of fertility with and without lime. Half of the plots were treated with minor elements. The chemical results on these samples will measure the lasting effects of the minor elements.

When some of these plots were limed, the yield of oats was markedly decreased. To see if this depressing effect occurred with other soils, four different Paxton soils and one Gloucester soil were used in the Greenhouse. On all five soils the two-ton application of lime, as well as the six-ton application, decreased the yield of oats. As was expected, the oats did not yield as well on the Gloucester soil.

G. P. Percival, D. Josselyn

Preservation of Carotene in Legumes and Grasses.

Samples of timothy, ladino, brome, alsike clover, red clover, and alfalfa were stored as field-cured hay, mow-cured hay, molasses silage, and SO_2 and plain silage, with and without packing. Again the advantage of ensiling forage for the preservation of carotene was outstanding. The SO_2 packed silage showed the least amount of loss. Untreated packed was in second place with molasses silage a close third.

G. P. Percival

OTHER ACTIVE PROJECTS

The Carbohydrates of Pasture Grasses.

T. G. Phillips, M. E. Loughlin

A State-Wide Survey of the Nutritive Value of Home-Canned Fruits and Vegetables in New Hampshire.

S. R. Shimer, H. P. Shimer. D. Josselyn

Agricultural Economics

New Hampshire's Idle Farm Land.

The following is the summary and recommendations from a bulletin in process:

The situation varies somewhat from place to place (the principal variations are presented in studies of six towns), but the following general statements seem justified:

1. The 20 towns studied each had from seven to 37 places containing idle or nearly idle farm land. There was an average of 19 such places and 631 tillable acres, plus somewhat less nonwooded pasture, per town.

2. Some of these places have enough agricultural land for a commercial size dairy farm (20 or more cows), more are of doubtful commercial size, but the greatest number are distinctly less than commercial size.

3. Such places may be found anywhere, but areas near plentiful nonfarm employment opportunities, areas offering good views and some privacy, and accessible small-farm areas tend to have more agriculturally idle places.

4. A few places are owned by wealthy persons, but many are owned by persons of modest means in about this order of frequency: Local nonfarm workers; local and outside business and professional people, some active and some retired; women heirs of farmers; unsettled estates; retired and semiretired farmers; and others too varied to classify.

5. Some of the larger places were taken out of farmer ownership by persons of wealth. Others are held by persons of moderate or small means for reasons of sentiment, uncertainty, indecision, future plans, etc. Apparently a majority of the places below commercial size ceased to be farmed as they became too small for complete farm units; the rather small acreages of good land, their distance from active farms, and the value of old farm houses have been against the incorporation of these small places into adequate size farmer-owned holdings.

6. The principal present use of most of these places is as full or part-time residence of the owner.

7. There are a few opportunities for developing dairy farm units on places now idle or nearly idle. However, on most places the farm land could best be used to supplement another farm — this applies even to the larger places because adequate buildings are seldom available for a tenant-farmer.

8. Principal reasons given by owners of idle land for not currently renting included, in order of frequency, no inquiries from renters, rented for partial use, mistrustful of renters, owner may farm in futue, owner partially uses, place is for sale, and indecision as to future of place.

9. About one third of the owners were willing to rent their farm land and about one fourth might be persuaded. A few farmers wanted farm units and more wanted some additional land. The farmers needing land might use the better and more conveniently located pieces now idle.

10. Owners often lack the interest or the means to make needed land improvements. Farmers tended to be willing to fertilize and reseed if they could get a long-term lease. Owners frequently indicated willingness to give a long-term lease if the farmer made the improvements. Other owners would not give long-term leases because of their uncertain plans.

11. Owners often have little knowledge of agriculture, of how their land might be used, or of what would be fair rental terms. Lease terms are not well established. Potential suppliers and potential users were not well known and were often reluctant to approach each other.

12. Over half of the dairy farmers in two towns were using other people's land in some manner. Some farmers were using several pieces of "rented" land and some were using pieces several miles away. However, much of this use is very light, leases are uncommon, most land improvements (other than on farms rented as complete units) are made by the renter and these are less than they would be if the renter's investments were more secure. An imperfectly established rental market may help limit the amount of renting.

13. Making available to farmers suitable land now idle (or that may become idle) should assist in maintaining a supply of farm products in New England at a lower cost than may otherwise be the case.

14. Many individual farmers, especially those on small farms and young men short of the capital to start farming, have opportunities to gain through the use of some idle land.

15. Many individual owners of idle farm property have opportunities to obtain current income, reduce ownership costs, or improve the sale value of their property by making it available for suitable farm use.

Recommendations: 1. Individual farmers, particularly established operators of small farms and those seeking to get a start with limited capital, or seeking to help sons get started, should study the possibilities in the active, moderately intensive use of rented land.

2. Individual owners of idle or semi-idle land should study the possibilities for increasing current income, decreasing current expenses, or maintaining the value of their investments through having their farm land more actively used.

3. Idle and semi-idle places need to be listed, their farm resources in land, buildings, etc., indicated, the owners' willingness to sell or rent determined, and the list made available to interested farmers. The information might be compiled in each town by the selectmen and made available through the County Agent's office. A similar list of interested farmers might be made available to interested nonfarmer owners.

4. Agricultural agencies, especially the Agricultural Extension Service, should publicize the opportunities in renting, the essentials of good renting, and aid in working out agreements in individual situations. Nonfarmer owners and would-be renters should feel free to seek the aid of these agencies, usually beginning at the office of the County Agricultural Agent.

5. Interested local agencies, such as town planning groups, might participate in listing idle land suitable for agriculture, interesting owners in making it available to farmers, informing farmers of its availability, and, possibly with the aid of agricultural specialists, working out suitable rental or sale agreements.

W. K. Burkett

The Economics of Dairy Herd Replacements.

The current embargo on shipments of cattle from Canada into the United States calls attention to a problem of long standing in New England: How best to obtain the many replacements needed each year in the dairy herds of the area. New England has been supplying only 79 percent of its own replacement cattle during the past ten years. Southern New England has been particularly dependent on imports of dairy cows. Net inshipments during the past 10 years have accounted for 45 percent of the total replacements. Northern New England, however, has been practically self-sufficient and during 1951 had a net outshipment of 7,143 head.

New Hampshire has been raising enough replacements to satisfy its needs and to provide some surplus cattle for shipment to other states, particularly to those in Southern New England. The embargo on Canadian cattle has eliminated about 25,000 head of cattle normally shipped into Southern

New England from Canada. New Hampshire dairymen have an opportunity to produce more high-quality dairy replacements for sale in this market. The use of roughage, barn space, or labor which cannot be used for carrying dairy cows makes raising additional youngstock particularly profitable. The raising of surplus youngstock for sale as replacement dairy cattle is an especially good adjustment for farms distant from the milk market. This is the case, since the price of milk is much lower than the price of replacement cattle in these areas.

W. F. Henry

Management Problems in the Use of Mow Hay Driers.

In the study of mow hay driers, the emphasis has been on the management problems associated with their use.

Larger application of fertilizer and new practices have resulted in heavy yields of early-maturing, slow-drying legume mixed hay. Since this must be harvested early in order to obtain best quality of feed the farmers have had difficulties in curing and storage.

Details are available from the study as to how a few individual operators handled their facilities for curing and storing roughage. The situation on one of these farms is described here.

The operator had 58 acres of high-yielding legume grass hay, and facilities for grass silage, mow drying, and field curing hay. The total yields of hay in the 1951 season, including 15½ acres harvested as grass silage, was approximately 225 tons dry hay equivalent. This is 3.9 tons per acre. The first crop yielded 157 tons and the second crop 68 tons.

The operator had an objective in harvesting the first crop as early as possible in order to obtain high-quality feed and to favor a good second crop. He harvested 135 tons of grass silage (45 tons dry hay equivalent) and 879 bales of mow dried hay (about 22 tons) in the period June 12 to June 30. Twenty-nine percent of the first crop roughage was harvested as silage and 14 percent as hay, a total of 43 percent before July 1. The remaining 90 tons of hay were in the barn by July 15. The early cut hay was put on the mow drier and 55 tons of the hay cut in July was field cured and stored in the usual manner.

The availability of the mow drier for part of the crop was a factor in the operator's management in early haying. He was conservative in the use of the drier and usually almost completely field cured the hay before putting in the mow drier. On the other hand, he would occasionally start loading and hauling hay a little sooner than he would have if hay drying facilities were not available. The operator probably made use of his available labor more continuously and completed the harvest at an earlier date.

In the 1950 season this operator took advantage of an early good weather period and harvested 63 percent of his first crop by July 1.

In contrast, another operator with facilities for both grass silage and mow curing did not get under way until after July 1.

J. C. Holmes

Efficiency Measures for Milk Distribution.

Increasing costs of milk, machinery, and services necessitate that milk processors and distributors must continually assess the efficiency of their operation. This is necessary if an adequate return on their investment is to be made.

This study develops two simple measures of distribution efficiency, namely, man hours and truck miles per unit of milk delivered. These data were obtained from dealers in four Merrimack Valley markets and the study compares efficiency between markets and within markets for the years 1941, 1945, and 1951. The findings show declines in efficiency since 1945, when delivery every other day was introduced, in most of the markets. The major objective of the study, however, is to provide comparative guides for examination of delivery operations both market wide and individually. More detailed study of specific cases can then be made in an attempt to improve the net income of operating firms within the industry.

J. R. Bowring, J. C. Holmes

Handling Purchased Grain at the Farm.

Preliminary observations were made on a limited number of poultry and dairy farms to obtain information concerning methods and labor involved in handling, storing, and feeding purchased grain. The data obtained indicate large variations in the time and effort spent on grain handling.

Most dairymen and poultrymen store and handle grain in 100 lb. bags, but a few were found who store and handle grain in bulk. On dairy farms the usual position of bulk grain bins was on the floor above the cows with an outlet available to fill the grain cart in the feed alley floor.

Several poultrymen had no mechanical means of elevating grain to the second and third floor. In one case the grain was stored in bags on the first floor and carried up a flight of stairs as needed. In several cases the burden of delivering grain to the second and third floors was put on the grain dealer. On one farm several tons a week had to be thrown up by two men from the truck to the second floor. The grain dealer was obligated to send an extra man on the delivery truck.

Only two poultrymen visited were receiving grain by bulk delivery. In one building on a side hill, grain was delivered to a bulk bin on the third floor and was available through spouts to outlets on all floors. One operator purchases grain in 100-lb. bags, elevates 10 bags at a time with hay sling ropes, and empties the bags into a bulk bin at the top of the barn. Grain was then available on all floors and all pens by gravity feed.

Approximately 15,000 lbs. of grain (150-lb. and 100-lb. bags) are required per week to supply 8,000 layers in a large poultry house. Under conditions in several farms, the 100-lb. bags are handled several times in the process of transfer from truck to storage and from storage to feeding. The handling of grain in 100-lb. bags may be fairly efficient on some farms on the basis of man hours, but it is a real hardship to a large proportion of the workers employed on poultry farms.

H. C. Woodworth

Management Adjustments in Potato Production.

The 1920 Census of Agriculture for New England reported 16,152 farms harvesting 1,342,000 bushels of potatoes on 13,334 acres. The corresponding figures in 1950 were 5,161 farms harvesting 1,125,000 bushels on 4,214 acres. (Census figures are for the preceding crop year in each case.) Thus, bushels harvested had been nearly maintained while the number of farms and acres growing potatoes had declined by nearly two-thirds.

In this period, average crop yield (using yields of more than the two above crop years) approximately doubled due to improved practices on many farms. But changes of another kind, drastically affecting the place of potato production on New Hampshire farms, were taking place. Information pieced together from several sources suggests the economic forces back of these changes, the adjustments that growers have made so far, and further adjustments that may need to be made.

Probably even in 1920 many of the farms reporting potatoes were not growing them primarily for sale. However, farmers who recall that period say that a great many farms grew some potatoes, seldom over three or four acres, as a cash crop. Using considerable hand labor at times of the year when other farm work was relatively light, potatoes fitted well as a supplementary enterprise on dairy and general farms. That is, they used resources left over from the main enterprise. By the late 1930's and the 1940's the development of efficient row-crop tractors and adapted potato equipment had enabled specialized potato production to become highly mechanized. The growers with small supplementary acreages were under economic pressure to make adjustments, the extremes of which were to mechanize and expand or quit potatoes.

In 1949 the Production and Marketing Administration listed the measured acreages of 354 potato growers in New Hampshire. We may assume that the remainder of the 5,161 farms of the Census were growing their potatoes primarily for home consumption. The 354 growers may be classified by size as follows: under 3 acres of potatoes — 203 growers; 3 to 9 acres — 92 growers; 10 to 19 acres — 26 growers; 20 to 29 acres — 16 growers; 30 to 39 acres — 5 growers; 40 to 49 acres — 3 growers; and 50 and over acres — 9 growers.

Most of these growers received mail questionnaries and some were interviewed. Most of those in the under-3-acre group were not growing potatoes primarily for sale. Some were commercial farmers, principally dairymen, and some were off-farm workers. Most had little potato equipment, their yields were low, and there was little interest in commercial potato production.

The greatest number of the 3-to-9-acre potato enterprises were on dairy farms, especially in Coos and Grafton counties. These were mostly commercial potato enterprises, but they are distinctly secondary enterprises if the operator has a full-scale occupation. Potato production on these farms is partly mechanized with semi-obsolete equipment (although there are great variations from farm to farm). The continuance of acreages of this size may be dependent on hiring the expensive specialized machines.

The 10-to-19-acre potato enterprise tends to occur most frequently on dairy farms, sometimes on fruit, vegetable, and mixed farms, and seldom as a side line to off-farm work. The 10-to-19 acreages is still secondary and supplementary to a main enterprise. However, it is more likely to occur on a two-man than a one-man dairy farm. This group tends to be fairly well mechanized in the growing operations, although some of their equipment is smaller than that of the larger growers and they lack some of the harvesting and storing equipment. Their tractors, trucks, and tillage machines are owned for their main enterprises whether they grow potatoes or not. Potatoes would seem fairly well established as a supplementary enterprise on these farms. These are probably most often farms where the main enterprise, frequently dairy, cannot readily be expanded to fit the labor force and where land, often rented, is available.

From about 20 acres up, potatoes take on the character of a major, specialized enterprise. They may be associated with other enterprises, farm or nonfarm, but they tend to become a major companion enterprise, if not a dominant one, in relation to the others. Of the 20-to-39-acre group, about equal numbers reported dairy, vegetable, and off-farm enterprises. From 40 acres up, off-farm and no other occupation occurred more frequently. As a group, the 20-acres-and-over growers, and especially those with 40 acres and over, are about as fully mechanized as soil and field conditions and ingenuity of machinery makes and farmers permit. Productionwise they seem established to meet competition from other areas.

This study has in process two further steps designed to aid growers to make more detailed adjustments. The first is a presentation of the different equipment, crews, and performance-rates by individual operations as observed on several farms. The second is a calculation of least-cost machinery and labor combinations for different acreages and of high-profit acreages for growers with different amounts of time available for potatoes.

W. K. Burkett

Consumer Habits of Purchasing, Using, and Storing Apples.

Approximately 180 consumers were contacted in Manchester and Hampton for information concerning purchase and use of apples. In Manchester about 95 percent of those contacted were buying principally from retail stores. Thirty-five percent held apples in family refrigerators, 20 percent in cellars. About 80 percent of the families used apples during a 30-day period (February-March 1952). Apples were used in Manchester as follows:

96%	of the consumers used	71.0%	of the apples for dessert
57%	of the consumers used	16.0%	of the apples for pies
37%	of the consumers used	7.5%	of the apples for sauce
30%	of the consumers used	5.5%	of the apples for baking

In Hampton, the McIntosh, Cortland, Baldwin, Macoun, and Delicious were given preference in the order named.

The average price paid for McIntosh in Manchester was slightly over 10 cents per pound.

Over 80 stores were visited in Manchester. Thirty-seven percent bought their apple supplies principally from wholesalers, 33 percent from growers, 22 percent from peddlers, and 8 percent directly from warehouses or storage. The average gross margin taken by retailers on the McIntosh was about 31 percent.

A refrigerated apple vending machine, which carried four sizes or varieties of apples, was tested on the campus. Both 5 cent and 10 cent apples were used. In the period October 27 - December 12. McIntosh, Macoun, and Cortland 3-inch apples were available at 10 cents. Of the 1,217 apples sold, 45 percent were McIntosh, 32 percent Macoun, and 23 percent Cortland. A 2½-inch McIntosh was sold at 5 cents. Three-inch apples at 10 cents sold much better than 2½-inch apples at 5 cents to University students.

The vending machine should prove valuable to test consumer reactions. It also makes possible the sale of top-quality apples at attractive prices.

L. A. Dougherty

Commercial Cucumber Growing.

Commercial cucumber pickle growing would seem to fit very well into the economy of a limited number of rural families in New Hampshire. Only a small acreage is needed to afford employment for about six weeks in the harvest period. No specialized equipment nor large investment is required. A market for the crop is guaranteed at definite prices. Does this intensive crop which requires considerable hand labor in harvesting offer an opportunity to families, who have an acre of good tillage land, who have available underemployed family labor, and who need additional income?

Observations indicate that many growers did not adequately prepare the field for this intensive crop. Consequently the yields were low and the income unsatisfactory. Some fields were abandoned before or during harvest. Individuals or groups of growers could well consider making special arrangements to hire the land plowed, fertilized, fitted, and perhaps cultivated twice in order to obtain better yields. In fact, the new crop will be given a better trial if the processing company would employ a field man to work with the growers and help them develop the practices essential to obtain good yields.

In the study special emphasis was placed on efficiency of harvesting. In 1950 and 1951 experimental plots were laid out on productive fields to test the results obtained from different frequencies of picking. In both years daily picking resulted in greater value of cucumbers per acre, but less value per man hours of picking. The following table summarizes the frequency of picking experiment in 1951.

Picking frequency	Man minutes per plot	Total value per plot	Total value cucumbers picked per man hour
6 times a week	89.2	$2.15	$1.44
3 times a week	55.4	2.04	2.20
2 times a week	42.4	1.71	2.42
1.4 times a week	36.9	1.54	2.50

When the expenses up to harvest are included, the data indicate that picking two to three times each week made the most adequate use of resources.

H. C. Woodworth

Marketing Poultry Meat.

Broiler production in New Hampshire has increased from the part-time enterprise it was 15 years ago to the million-dollar industry it is today. In 1951 New Hampshire commercial producers sold over 18 million pounds of broilers valued at over 5 million dollars when they left the farms. In addition the important by-product of egg production, fowl, contributed 7⅓ million dollars to farm income and 25 millions of pounds of poultry meat to consumers.

The use of poultry meat in families has also increased greatly. In 1935 each person consumed 18 pounds. Today this per capita consumption has advanced to 30 pounds each year, an increase of two thirds.

The movement of these large quantities of poultry from producers to consumers is the problem of this study. A description of the present methods of marketing in the state was made first. But this provides only a point of departure. To be purposive and to make a contribution to progress, research

must move from mere description to careful study — and from study to the development of new and more efficient methods of marketing.

Therefore, the purposes of the study are to determine the best way to move our poultry to market, to indicate how this differs from the present system, and to interest producers and handlers in trying out and using the improved methods.

Preliminary analysis of data so far collected shows that live poultry dealers handled about 11 million pounds of birds in 1951. Almost 50 percent of these were broilers, with fowl accounting for 30 percent and chickens 20 percent. A great many of these birds went to processors in the state and the rest were shipped live to other areas. New Hampshire processors handled almost 30 million pounds of birds in 1951. The greatest number of these were fowl, amounting to almost 79 percent, with chicken at 15 percent, and broilers at 6 percent.

W. F. Henry, J. R. Bowring

Handling and Merchandising Locally-Grown Vegetables.

Carrots can be grown in New Hampshire which will compare favorably with the California and Texas carrots being sold in our markets. Retailers definitely prefer the long slender carrots of which Imperator is an example. Deeply tilled, sandy loam soil is desirable if a long, smooth carrot is to be obtained.

Consumer tests showed preference for the Nantes variety, with Imperator second. The former variety, however, has a weak top and in that respect is not liked by either grower or retailer.

Washing facilities are needed to do the job quickly and well. Most growers either do not wash carrots well or else spend an excessive amount of time doing the job. Sizing is poorly done in many cases. Few of our markets have a full supply of local carrots even at the height of the season.

Packaged carrots are being used in increasing quantities and retailers prefer them because of reduction in losses and ease in handling. Many stores now carry carrots both packaged and with tops.

Of the consumers contacted who had purchased freshly-picked iced corn, 76 percent said the corn was better than recent purchases, 55 percent used their corn the same day purchased, and 60 percent held corn in refrigerator after purchase.

At the height of the corn season, about 70 percent of the retailers were buying corn from local producers. Only 36 percent knew the names of growers from whom they bought, which indicates growers did not sufficiently impress the brand and source of supply on retailers.

No growers were icing corn and many picked the day before. Retailers were not very exacting as to time of picking or method of handling as long as it looked fresh.

L. A. Dougherty

OTHER ACTIVE PROJECTS

Problems of Obtaining Farming Capital.

W. K. Burkett

Agricultural Engineering

Crooked Toes in Poultry May Result from Cold Floors.

Cold floors are a contributing factor to the crooked toes found on many birds brooded under infrared lamps. Twenty birds brooded under an abundance of infrared energy on a warm floor showed slight, if any, tendency toward crooked toes while twenty other birds from the same hatch, under the same amount of infrared energy, on a refrigerated floor, all showed crooked toes of varying amounts. From this it seems safe to conclude that infrared energy alone is not a cause of crooked toes.

Work done on the reflection and absorption of infrared energy by the various poultry litters commonly used in New Hampshire indicate no appreciable difference. Sawdust had a slight edge over shavings and sugar cane in absorption while shavings showed slightly superior reflection characteristics.

W. B. Schumacher, B. P. Rines

OTHER ACTIVE PROJECTS

Sawdust Drying.

A. G. Fox

Agronomy

Hybrid Corn in New Hampshire.

Since 1936, when the corn variety trials were started by the Agronomy Department, there has been a decided increase in both silage and grain yields per acre. This is due to the fact that the lower yielding varieties have been discarded and new high-yielding hybrids have been included as soon as they have been released. It is estimated that about 90% of the silage and grain corn grown in New Hampshire is from hybrid seed. Over the years, increased yields were first noted in the hybrids harvested for grain, but in recent years silage yields have begun to climb. This is important since about three fourths of the corn grown in New Hampshire is harvested for silage.

1951 was a good corn year because, unlike 1949 and 1950, there was ample rainfall. The Durham yields for both grain and silage averaged the highest ever and the Claremont and Lancaster yields were very good.

Cornell 29-3 continues to be the leading early-silage and late-grain hybrid in spite of the fact it suffers "stock breakage." The new Massachusetts 63 and the high yielding Wisconsin 335 are good grain corns for southern New Hampshire and rank high as silage hybrids in the northern countries. Ohio M-15 and K-24 and Wisconsin 29-3 give good returns for late maturing silage.

In northern New Hampshire, the dent-flint hybrids such as Maine B and Wisconsin 240 can be grown for grain in place of the lower yielding open-pollinated flints.

Silage yields in the 1951 trials averaged 20 tons to the acre and grain yields averaged 75 bushels to the acre. These yields cover about 40 corn hybrids grown in replications in the three State areas.

L. J. Higgins

Disease-Resistant Oats for New Hampshire.

The uniform oat nursery trials carried out at Durham with the cooperation of the U.S.D.A. are not only a benefit to New Hampshire but are gaining somewhat of a reputation in the U.S.D.A. It seems that the humidity found in southeastern New Hampshire gives rise to an abundance of oat disease infections.

Dr. Stanton, former Head U.S.D.A. Oat Investigator, made his first visit to New England soon after the Durham oat nursery was established in 1943. Since then, Dr. Coffman, in charge of the U.S.D.A. oat investigations, has visited the Durham plots twice. On his first visit, he found a trace of stem rust that had not appeared in this section of the country before. Recently, on the second inspection, Dr. Coffman found more disease in the U.N.H. nursery than he had encountered before.

Only two of the newest varieties showed marked resistance to disease this past year. These varieties have only been released for testing and have not been multiplied to an extent where seed is available for farmers. When seed is available, New Hampshire farmers may experience greater yield returns than when they changed from the old varieties to such varieties as Clinton, Ajax, and Mohawk.

In addition to the Durham trials, variety trials were carried on at Lancaster and Claremont for both forage and grain yields. The Lancaster yields always run high due to the lower mean temperature and less humidity which results in less disease infection.

L. J. Higgins

New Potato Variety Popular with Both Consumer and Producer.

Of the twenty-odd varieties that have been tested the last few years, Kennebec is the most promising to date. It is a high-yielding variety and is blight resistant, making it popular with the grower. This variety is also popular with the consumer because it is shallow-eyed, good for boiling and baking, and excellent for french fries. The Kennebec is also excellent for potato chips and is already in demand by the rapidly growing potato chip industry.

Another promising variety is as yet unnamed but is known as B 355-44. This variety is high in starch like the Green Mountain, but is easier to grow because it is not susceptible to blight and net necrosis.

P. T. Blood

Breeding for Better Legumes and Grasses.

The work in improvement of smooth brome grass was begun this spring with the establishment of a source nursery of about 2,200 plants representing 54 strains and varieties. It is expected that major emphasis will be placed on obtaining resistance to the brown leaf spot organism. The self, open-pollinated, and polycross progenies of these strains will be artificially inoculated with this organism as well as studied in the field for disease reactions.

A yield test of 10 varieties of brome grass was established at Colebrook and Durham this year in three replications alone and three with ladino clover. Both northern and southern types of brome grass were included to obtain information as to the relative competition given to the associate legume. A test of 5 synthetic strains of brome grass developed by Dr. Murphy of Cornell was also seeded at Durham.

Yield records were again obtained on the ladino strain test at Durham. It is expected that a source nursery of ladino will be established this fall or next spring. Considerable emphasis will be given in the ladino program to obtaining resistance to the stem rot organism (Sclerotinia trifoliorum).

Measurements were made for height, leaf width, and length, and leaf to stem ratios taken for the timothy selections which had been made previously. The height, leaf length, and width values will be correlated with the leafiness of the clones in an attempt to obtain information which will aid in selection and breeding for greater leafiness.

Since the succeeding generations of the original red clover plants found under isolated conditions continued to persist longer than the usual two years, a new lot of breeders' seed was gathered in 1951 under greenhouse isolation conditions. This seed was further multiplied in the greenhouse and in the field with the object of setting up replicated yield trials with other red clover varieties in New Hampshire and other states.

G. M. Dunn, F. S. Prince, L. J. Higgins

Too Little or Too Much Boron for Potatoes?

Feeding minor elements to plants is very often a ticklish problem. They may be needed in only a few parts per million yet without this trace plants may suffer serious diseases. On the other hand quantities only slightly larger than those needed for normal growth may be toxic. Boron is a good example of such a minor element. About one part per million in solution is absolutely necessary for proper growth of potatoes but as little as 15 parts per million is toxic.

Some commercial potato fertilizers are being formulated with additions of boron. Studies on a Worthington loam in the Colebrook area have been underway to determine whether continued use of such a fertilizer might result in reduced yields of potatoes. In 1950, after using a borated fertilizer containing 5 pounds of borax per ton for 5 consecutive years, a reduction in yield of 44 bushels was obtained. In 1951, in the sixth year of the test, there was no decrease in yield from the borated fertilizer although soil tests have indicated a slow increase in the available boron content of the plots which have been receiving the borated fertilizer.

The cause of the difference in the effect of the borated fertilizer in the two years is not known definitely, but it is thought that the relatively dry growing season in 1950 may have resulted in a higher boron concentration adjacent to the fertilizer bands, while in 1951, a relatively moist season, the boron would not be as concentrated in the soil solution.

As far as potatoes are concerned, it looks as though the farmer growing potatoes continuously will have to be careful in his use of borated fertilizers or too little may become too much.

F. S. Prince, L. T. Kardos, P. T. Blood

Ladino Clover Needs Both Lime and Potash.

Field experiments on two important soil types, one in northern New Hampshire and the other in southern New Hampshire, point out that lime and potash go hand in hand in increasing the yield of ladino clover.

In the Colebrook area in northern New Hampshire, on a Worthington loam soil, when lime was used without potash the ladino yield was increased

144%; when potash was used without lime the yield was increased 180%; when both potash and lime were used the yield increase was 315%.

In southern New Hampshire, at Northwood, on a Paxton loam when lime was used alone the ladino yield was increased 130%, when potash was used alone the yield increase was 600%, but when both lime and potash were used, the ladino yield was increased 1200%.

F. S. Prince, L. T. Kardos

Irrigation Results in Better Quality Forage.

Rainfall during the 1951 season was ample and evenly distributed so that at no time was soil moisture level low enough to call for irrigation. The index for irrigation was a Bouyoucos gypsum block reading of 9000 ohms anywhere in the profile to a depth of 16 inches. The highest resistance found during the season was 7000 ohms, so no supplemental irrigation was used.

Since the experiment was started in 1950 on a newly seeded field and a very much better stand of grass and clovers was secured on the irrigated area, it was of interest to determine to what extent this difference would extend over into the second year of the stand. Surprisingly, the area which was not irrigated in 1950 recovered tremendously in 1951, and there was relatively little difference in yield of total forage from the areas which had been so different in 1950.

The residual effects of the irrigation in 1950 were reflected, however, in the quality of the forage as shown in the following table:

Treatment		Ladino	Red Clover	Total Legumes
1950	1951	%	%	%
Irrigated	Natural rainfall only	11.9	38.4	50.3
Unirrigated	Natural rainfall only	9.6	33.7	43.3

Soil type also had some influence on the stand. The experimental area had two distinct soil types: Charlton, a well-drained soil, and Buxton, an imperfectly drained soil. The Charlton had relatively less ladino and more red clover, while the Buxton had more ladino.

This indicates that soil type has some influence in getting and keeping a stand of ladino clover when drought becomes severe. Both soils on which the irrigation water was applied are better than average for forage production. If a soil such as a Merrimac loamy sand had been used, the results would, no doubt, have been more spectacular.

F. S. Prince, P. T. Blood, K. S. Morrow

The Use of Drainage Ditches.

Drainage ditches and beds constructed on the 80-acre Moore field in Durham continue to be effective in removing the water from the poorly drained Whately and Biddeford soils. The 100-foot beds are a little more satisfactory than the 75-foot beds for turning the equiment during hay harvest and both of these provide better drainage than the 200-foot beds. Hay yields remain high and the initial investment in drainage should be paid off within several years. The costs, yields, and water table measurements will be summarized this year.

W. H. Lyford

Alfalfa and Birdsfoot Trefoil Better Than Ladino Clover on Droughty Soil.

Seedings of four perennial legumes with timothy were made in the dry year of 1950 on a droughty Stratham gravelly loam in southern New Hampshire. In 1951 the plots were harvested as two cuttings of hay, and the persistence of the legumes was determined from a botanical analysis of the crops.

The results indicated that alfalfa and birdsfoot trefoil survived best and the perennial red clover and ladino poorest.

The yields of legume in the second cutting of 1951 expressed as pounds of dry matter per acre were as follows: alfalfa, 2104; trefoil, 1093; red clover, 290; and ladino, 47.

On another soil type — the Paxton loam, with good moisture-holding properties so that drought was not as vital a factor — the order of survival was quite different. Ladino clover persisted best, with alfalfa and red clover next and about equally good, and trefoil poorest.

The results particularly emphasize the importance of considering the physical properties of the soil when selecting a perennial legume for maximum persistence in a grassland program.

L. T. Kardos, P. T. Blood

Soil Survey.

During the past season there was additional soil surveying in Rockingham County, but about 40 square miles in the vicinity of Northwood and Deerfield still remain to be done. Lack of experienced personnel has slowed up the work in Rockingham County, but it is hoped the work there will be completed soon. Following completion of the field survey, a report will be written and published with an accompanying map.

The soil survey report and map for Hillsboro County is in press.

When the soils of Strafford County were mapped, the land use was also obtained. The latter information was not published with the soil map but has been worked up during the past winter. The soil and land-use relationships have been summarized in tabular form, and may be available in an Experiment Station publication.

W. H. Lyford

2,4-D Will Control Weeds in Corn That Is 12-18 Inches High.

The best time to control weeds in corn is before the corn gets more than 6 to 8 inches high, but it was found that fair control was obtained when the corn and weeds were 12 to 18 inches high. Ten gallons per acre of a solution containing half a pound of 2.4-D (acid equivalent) applied at this stage of growth did not injure the corn, but killed or stunted the weeds to the extent that they did not produce viable seed.

P. T. Blood, F. S. Prince

OTHER ACTIVE PROJECTS

The Influence of the Level of Available Potash in the Soil on the Longevity or Persistence of Ladino Clover in Hay Stands.

F. S. Prince, L. T. Kardos,
P. T. Blood, A. E. Teeri

Bacteriology

Studies on Bovine Mastitis.

Studies on the diagnosis and control of staphylococcal mastitis have been continued. A practical and efficient method for the diagnosis of this infection has been developed. The staphylococci have been found to be an important cause of mastitis in many New Hampshire dairy herds. Treatment with 2 or 3 infusions of 400 mg. of Aureomycin in an ointment base at 48-hour intervals eliminated the infection in about 65 per cent of the quarters treated. Quarters not cured usually had a history of a long-standing chronic infection. Such quarters were not cured when treated with Pendistrin (penicillin and dihydrostreptomycin) or with Terramycin. Studies are being continued on the treatment and control of this type of bovine mastitis.

L. W. Slanetz, F. E. Allen

OTHER ACTIVE PROJECTS

Diagnosis and Control of Vibriosis in New Hampshire Dairy Herds.

E. Katz

Botany

Tomatoes Resistant to Late Blight.

Late blight killed nearly every tomato plant in New Hampshire in 1951 and caused most of the tomatoes to rot. However, a few plants at the Horticultural Farm remained green and healthy, and their fruits ripened normally. These were from two small-fruited blight-resistant lines. Crosses between these lines and large-fruited varieties have been made, most of which are susceptible to late blight. However, it is hoped that a large-fruited resistant progeny with desirable horticultural characters will eventually be obtained.

A. E. Rich

New Organic Fungicides Give Good Control of Apple Scab and Excellent Fruit Finish.

Although sulfur is still the most widely used fungicide for the control of apple scab, several new materials have been tested which give better scab control under severe conditions.

Experiments have shown that Phygon XL is an excellent protectant and that Puratized Agricultural Spray is a very good eradicant. Other materials which gave good protection from scab and which show promise, especially from the standpoint of fruit finish, include Thiram, Crag, and Fungicide 406.

A. E. Rich

Composting Aided by Hen Manure and Green Vegetation.

Plots were continuted, raising corn in four variables: (1) control — fertilizer only, (2) manure, (3) rotted sawdust, (4) fresh sawdust. The total yield was greatest for the rotted sawdust, which was consistant with the three previous years. However, the differences were not significantly greater. Pot cultures of plants were continued, using various mixtures of hardwood (birch) shavings. The mixtures had been composted in outdoor pits for

more than one year. Owing to an extremely wet season, the lower levels of the pits were under water and decomposition was neither very rapid nor complete. The yields from such crops as radish, Swiss chard, and barley, grown in these materials, indicated that hen manure, ground limestone, and chopped vegetation are important aids to composting.

Mixtures of sawdust with macerated green vegetation, manure, lime, and fertilizer composted indoors in jars gave best yields for the first two ingredients.

One crop grown in sawdust plus sewage sludge, with or without soil, gave better yields than controls in soil only. All were fertilized uniformly.

Outdoor bins of sawdust composts were started with various mixtures of sawdust and hen manure, green vegetation, sewage sludge, and superphosphate. These are still in the composting process.

S. Dunn

Native Blackberries of New Hampshire.

To supplement the research now being carried out in the Horticulture Department on Rubus, a floristic and taxonomic study of the blackberries of New Hampshire is now under way. During the season of 1951, collections were made in nearly all counties of the state. These have been studied carefully in the University Herbarium with the result that, while numerous hybrids were recognized, most of the speciments could be placed within wide-ranging and clearly established species. It is evident that minor characteristics have been employed in the past much too frequently in setting up or maintaining new species of Rubus. As a result of this past summer's work, it becomes apparent that if extensive collection and field observation proceed hand in hand with herbarium study, it will be possible before long to work out a practical and useful guide to the New Hampshire species.

A. R. Hodgdon

New Plant Diseases in New Hampshire.

Several diseases which have not previously been reported in New Hampshire were identified during the past year. A disease of celery was found to be associated with a nematode *(Paratylenchus hamatus)*. An asparagus-tip blight was caused by *Botrytis* in the fall of 1951. Cabbage yellows was collected in the summer of 1952. Needle blight of red pine was observed in the fall of 1951.

Other diseases which are gaining in importance include *Verticillium* wilt and pink-eye of potato, and Dutch Elm Disease.

A. E. Rich

OTHER ACTIVE PROJECTS

Control of New Hampshire Weeds Using Herbicidal Methods.

A. R. Hodgdon

Crops

(See Agronomy)

Dairy Husbandry

Persistency of Milk Yield Is Influenced by Certain Factors.

Persistency of milk production at a high level is considered to be a desirable attribute of a dairy cow. Among dairymen, there is considerable difference of opinion regarding the factors that influence persistency. Age, inheritance or heredity, season of freshening, methods of feeding, and even the breed have been assumed to influence separately or collectively the persistency of milk yield during a lactation. The availability of daily milk weights for all cows in the University of New Hampshire herd over a period of approximately 20 years offered an opportunity to study the relation of certain factors to persistency of milk production.

Thirty-one Holsteins, each with 4 lactations, were used in the study. Persistency factor was computed by relating milk yield (F.C.M. basis) for subsequent 10-day periods from the 30th to the 210th day of the lactation.

Persistency was found to be significantly influenced by peak yield. After correcting for the influence of peak there was a significant difference favoring fall freshening in comparison with each of the other three seasons. There was some advantage in persistency for winter freshening over summer. Age was found not to be a significant factor. There was a correlation between the first and second lactation only.

K. S. Morrow

Sex Ratio in Dairy Cattle Is Not Influenced by Normal Herd Management Practices.

If the sex ratio in dairy cattle could be controlled. an important phase of the herd replacement maintenance problem would be solved. Countless theories of sex control have been suggested. To study the normal relation of certain herd management practices to sex ratio, data were analyzed on 1557 births in the University of New Hampshire dairy herd.

The over-all ratio of 94.0 males to 100 females was in contrast to ratios normally reported for dairy cattle in favor of males over females.

Season of the year at conception, age of sire and dam, gestation number, number of services, length of gestation, and length of calving interval were found to have no significant influence on sex ratio.

K. S. Morrow

The Vitamin D Content of Forage Varies Greatly.

A study was started several years ago to determine whether milking cows maintained under New Hampshire farm conditions need supplemental vitamin D. It was soon found that the first problem was to learn more about the vitamin D content of the common forages the cows eat and the factors which affect it. As a result, such a study covering a period of four years was carried out.

The results of the study show that the vitamin D content of forage varies widely depending on a number of factors. The vitamin D content of first-cutting forage harvested at the generally recommended stage of maturity was generally low when mowed and it could not be increased greatly by ultraviolet irradiation. Similar second-cutting forage was often higher in

vitamin D when mowed, and it contained appreciable amounts of vitamin D after irradiation. Relatively high levels of vitamin D were found in forages cut at a mature state, and these values were increased markedly after irradiation.

The results of this study indicate that first-cutting forage harvested at the generally recommended stage of maturity cannot be counted on as a good source of vitamin D even if it is field cured. Because second-cutting hay generally contains considerable vitamin D after field curing, the practice of ensiling first-cutting forage and making the second cutting into hay appears to be a desirable one. This is true not only from the standpoint of the vitamin D intake of the cow, but also in conserving other nutrients.

H. A. Keener

Sulphur Dioxide Excells Molasses as a Silage Preservative.

There has been considerable interest among dairymen in the use of sulphur dioxide as a silage preservative during the last few years. While there were many favorable reports on this material as a silage preservative, there appears to be no experimental work reported where this was shown by means of nutrient balance experiment with dairy animals. In order to determine the value of sulphur dioxide as a silage preservative and to compare it with cane molasses, a study of the relative digestibility and utilization of energy and protein of silages preserved with these materials was conducted.

Then complete energy-and-protein-balance experiments with six dairy heifers fed timothy silage and oat silage preserved with sulphur dioxide and with molasses show that the digestibility and utilization of these feed ingredients was higher in the sulphur dioxide-preserved silages. Both the oat and the timothy sulphur dioxide silages had much better color and keeping qualities than the comparable silages preserved with molasses. The palatability of the sulphur dioxide silages were equally as good as the molasses-preserved silages.

N. F. Colovos, H. A. Keener
H. A. Davis, A. E. Teeri

Digestibility and Utilization of Protein in Mow-Cured Hay Superior to That of Field-Cured Hay.

It generally is recognized that in New England the key to profitable dairying is the maximum use of high quality home-grown roughage. To achieve this objective to the greatest possible extent, it is necessary that the best possible method of harvesting and storing home-grown roughages for winter feeding be used. One of the concerns of this Station for the past three years has been the study of the relative digestibility and utilization of the protein and energy of mow-cured and field-cured hays. In twenty-two complete protein and energy balance experiments with dairy heifers over this period, it was found that the mow-cured hay excelled the field-cured hay in protein digestibility and utilization. The relative digestibility and utilization of the energy, however, was not significantly different in the two types of hay.

N. F. Colovos, H. A. Keener
H. A. Davis, A. E. Teeri

Too Much Limestone Lowers Digestibility of Both Protein and Energy in Silage.

In the course of the many experiments at this Station seeking the best possible method of harvesting and storing home-grown roughages for winter feeding, it was found that the digestibility and utilization of the protein of the silage was lower than that of either the mow-cured or field-cured hays from the same field. Because of the lower digestibility of the silage, it seemed desirable to try to find out what caused this depression. It was thought that pulverized limestone, a common mixed concentrate ingredient, might neutralize the acidity of the silage and perhaps improve its digestibility. The feeding of the limestone at a rate of 100 g. per day, however, caused a further drop of 6 to 8% in the digestibility of the protein in the silage. This very significant drop in digestibility of the protein posed the very important question as to the possible harm inclusion of lower amounts of minerals might cause to the digestibility of the ration. With that in view, an experiment was set up whereby the animals received limestone at levels of 0, 50, and 100 grams per day.

The animals receiving the 100 grams of limestone per day during the second experiment also had a significantly lower digestibility of protein than the animals receiving no limestone, thus confirming the results of the previous year. There was no significant difference in the digestibility of the protein by the animals receiving the 50 grams of pulverized limestone as compared to the animals receiving no limestone.

From the results of this study, it appears that the feeding of pulverized limestone to dairy heifers being fed silage rations does not increase digestibility of either the protein or energy. While rates of limestone up to 50 grams per day were not detrimental, higher rates were.

N. F. Colovos, H. A. Keener
H. A. Davis, A. E. Teeri

Influence of the Ration on Vitamin Synthesis in the Rumen.

The low quality of late-cut hay with respect to nicotinic acid and riboflavin was reflected in the decreased excretion of these vitamins by cows fed the hay. For the other rations fed, nicotinic acid excretion was unaffected, while the excretion values for riboflavin indicated that silage and possibly cane molasses favor the rumen or intestinal synthesis of this vitamin. Rumen synthesis of the thiamine probably is of considerable importance in ruminant nutrition, and the feeding of silage appears to favor this synthesis.

A. E. Teeri, D. Josselyn
N. F. Colovos, H. A. Keener

Does Sulfur Dioxide Affect Vitamin Synthesis in the Rumen?

Preliminary results indicate that synthesis of thiamine, by rumen microorganisms, is greatly increased when the ration contains sulfur dioxide — preserved silage. Hence, even though SO_2 destroys much of the thiamine in the silage, increased rumen synthesis of the vitamin counteracts the resultant deficiency in the ration.

The thiamine synthesis — favoring action of SO_2 is nullified by the presence of limestone but unaffected by molasses.

A similar synthesis — favoring action of SO_2 has been noted in connection with nicotinic acid, but in this case the effect is much less pronounced.

A. E. Teeri, D. Josselyn
N. F. Colovos, H. A. Keener

Rumen Microorganisms.

Studies were undertaken to obtain some information on the microorganisms present in the rumen of cattle. These organisms are responsible for the digestion of a large proportion of the ruminant's feed prior to its utilization by the animal. Particular attention was given to an investigation of the bacteria which are actively engaged in the digestion of the cellulose of the ruminant feed. Certain organisms were isolated from ruminal contents and a study of the nature of these forms and the products of their cellulose degradation was carried out. These products arising as a result of the bacterial digestion of cellulose are used by the ruminant in its nutrition. The bacterial forms isolated were a spore-forming rod and a yellow spherical organism called a coccus. Both live only in the complete absence of oxygen. Both seem to require some growth factor or factors (vitamins) present in rumen fluid as it is necessary to add this as a supplement to the cellulose mineral salts medium in order to obtain adequate growth. The products formed from the digestion of cellulose are chiefly fatty acids; however, the exact nature of these compounds is not known. Investigations are being carried out at the present time on this phase of the problem.

E. Katz

Dairy Heifers Make Greater Gain on Grass Silage.

Studies carried out during the past few years showed that grass silage when fed to 12 to 18 months old dairy heifers as the sole ration produced greater gains in body weight than either mow-cured or field-cured hay made from the same field. Similar experiments this year gave comparable results, although gains on all roughages were not as large as those of previous years. In the experiment this year the heifers fed grass silage made gains that were about twice as large as those made by the heifers fed mow-cured and field-cured hays. There was no difference in the gains made on the two hays.

The results of this experiment support the conclusion that was reported previously that grass silage contains some sort of growth-promoting factor in greater quantities than does mow-cured or field-cured hay made from the same field. These results also indicate that grass silage can be used more extensively in feeding dairy heifers in order to get normal gains in weight with smaller expenditures for grain.

H. A. Keener, N. F. Colovos
H. A. Davis, K. S. Morrow

How Does the Cow Use Sulfur from Sulfur Dioxide Silage?

Although sulfur dioxide has been found to be a very good silage preservative, the desirability of feeding relatively large amounts of sulfur from this source to the dairy cow has been questioned. Some people feel that the continued feeding of SO_2 silage may have harmful effects on the cow which would show up only after a considerable period of time. On the other hand, others believe that such quantities of sulphur would not be harmful and might even be of value nutritionally.

The first step in studying this problem was to determine what the cow does with the sulfur obtained from SO_2 silage. This was done by using a legume silage preserved with radioactive sulphur dioxide. This silage was preserved in steel drums and it was of excellent quality. After a period of five months it was fed to milking dairy cows and the metabolism of the radioactive sulfur followed.

The sulfur appeared in the blood within four hours from the time silage feeding started and in the milk at the next milking, which was in 15 hours. Approximately two thirds of the sulfur was absorbed and one third passed through the body in the feces. Most of the absorbed sulfur was excreted in the urine while only 1-2.6 percent of the radioactive sulfur fed appeared in the milk.

The results of this experiment indicate that sulfur from sulfur dioxide used as a silage preservative probably has some value nutritionally. On the other hand, the heavy feeding of such silage requires the elimination of rather large amounts of sulfur by the kidneys. Although this has not been proven to be harmful, it does indicate need for further study.

The project was done in cooperation with R. V. Harrington and R. R. Baldwin of Central Laboratories, General Foods Corporation, Hoboken, N. J.

H. A. Keener, A. E. Teeri

Minor Element Content of Forage Can Be Reduced by Heavy Fertilization.

Research work conducted at this Station and elsewhere has shown that as the yield of forage increases the cobalt content of the forage tends to decrease. Because of the increasing acceptance of the intensive type of roughage program, it seemed that if this principle applied to other minor elements, deficiencies other than cobalt might eventually affect the livestock of the area. Accordingly, an experiment to study this situation was started in 1949.

The first year the forage crops were heavily fertilized; both timothy and brome grasses were very low in cobalt, iron, and copper. Ladino clover was lower than normal in cobalt and iron, but not as low as the grasses. Last year cobalt remained at about the same level, but the amount of copper in all species was reduced somewhat. This was particularly true for ladino clover in which copper was only about one third the level of the previous year. In fact, the copper content of the ladino clover was lower than that of the brome grass with which it was growing. This is rather surprising in view of the generally accepted idea that legumes are generally higher in minerals than the grasses. The manganese content of all the forage species has remained within the normal range.

The low cobalt content of the forage resulted in cobalt deficiency in dairy heifers in about six months. This was true for both timothy hay and ladino-brome hay. After cobalt deficiency was encountered all animals were given supplemental cobalt so that other deficiencies would not be masked. All normal animals then seemed to develop normally for nearly a year, when apparently another deficiency appeared, first in the animals being fed timothy hay and later in those receiving ladino-brome hay. This condition is characterized by anemia in animals of all ages, also a misshapen spine in older animals, and poor growth rate in calves. Copper deficiency is suspected, but definite conclusions must await further studies. There is no indication that the low mineral content of the ration has affected the reproductive performance of the heifers adversely in their first gestation.

The project was done in cooperation with K. C. Beeson and E. J. Thacker, U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y.

H. A. Keener, F. E. Allen
K. S. Morrow, G. P. Percival

A Container for Carrying Bull Semen.

All the circuits of the New Hampshire-Vermont Breeding Association are now using the container developed as a result of this project.

In the near future the New Hampshire-Vermont Breeding Association will be offering service to eight breeds of cattle. Since the semen container holds 12 tubes of semen (later model holds 16 tubes) it means the technicians can carry these 8 breeds and still offer a selection of two series in the major dairy breeds.

There is no indication that the technicians are doing a better job with the semen container but it does make their job much easier to carry out, is less time consuming, and costs less than any other semen container that is now available.

H. C. Moore

OTHER ACTIVE PROJECTS

The Relation of Seminal Fluid Fructose Levels to Factors Affecting Breeding Efficiency.

C. H. Boynton

Entomology

Search for Synergists Continues.

The increasing resistance of insects to the newer chlorinated insecticides focuses attention on the desirability to attempting to improve some of the older well-known insecticides. Efforts have been continued to increase the insecticidal performance of pyrethrum, rotenone, and nicotine, through the use of synergists. Combinations of pyrethrins and rotenone are known to show synergistic activity when used against the housefly. However, when certain known synergists were used in conjunction with combinations of rotenone and pyrethrins, no increase in insecticidal activity was observed, beyond that which might be expected from the combination of a synergist and these materials, individually. Several additional chemicals were tested for synergistic activity with pyrethrins, but none showed promise in that respect.

R. L. Blickle, W. J. Morse

Field Tests with Newer Insecticides.

For the second successive year marlate. alone and in combination with lead arsenate, was usually effective and definitely superior to lead arsenate alone or in combination with DDT, for the control of plum curculio. Parathion with and without safener was slightly inferior to marlate.

In the control of the European corn borer on canning corn, a 3 percent DDT dust was superior to an activated Ryania dust (Ryanexcel). Best results were obtained when four applications were made at intervals of five to seven days. Under conditions of known infestation, fairly satisfactory results were obtained with a single application. applied when egg hatching was in progress.

In preliminary cage tests, Aramite dust, Lindane dust, and Genite-EM-923 emulsion controlled the red mite of poultry two weeks after time of application. Caged birds showed no deleterious effects after four weeks exposure to the materials used.

The need for better mite control on poultry is becoming more apparent with the rather general adoption of the system of housing birds continuously in litter, without the use of roosts. Under such conditions high populations of mites appear to be favored and there is a real need for improved miticides.

J. G. Conklin, R. L. Blickle, W. J. Morse

Spruce Insects.

Examination of permanent spruce budworm plots has indicated that this insect is not on the increase in New Hampshire at the present time.

The European spruce sawfly is present in very light numbers throughout the spruce areas of the state. It shows no indication of building up from year to year.

J. G. Conklin

Distribution of Blood-Sucking Diptera and Tricoptera.

During the past year the distribution of Tabanids in New Hampshire has been studied. Over 1500 specimens were collected and the known list of species for the state has been increased to 70.

Light trap records of mosquitoes are being continued, in cooperation with U. S. Public Health Service. A list of species found to date is now in process of publication.

Studies of the Tricoptera of New Hampshire have been undertaken and a list of species found to date is now in press.

J. G. Conklin

OTHER ACTIVE PROJECTS

Control of the Apple Maggot and Certain Other Economic Insects.

J. G. Conklin

Farm Management

(See Agricultural Economics)

Fertilizers

(See Agronomy)

Floriculture

(See Horticulture)

Forestry

Tree Thinning with Chemicals.

A little over a year ago a new technique was examined to determine whether it would be possible to inoculate unwanted cull trees with toxic materials sufficient to kill them and to leave them standing in the woods. Using ordinary blotting paper as a medium for absorbing sodium arsenite, small tabs of ½ inch x 2 inch were treated and dried. These tabs contained

approximately ½ gram of poison. A special tool was used to create a pocket between bark and wood of the tree so the tabs could be inserted. This tool is a small bark peeling spud smilar to a bent screw-driver. Forcing the tool straight into the tree through the bark, a vertical slit is started which readily opens when it is pried back with the spud. Then the spud is slid between wood and bark for about two inches. One of the tabs is applied at the edge of the slit, the spud is withdrawn, and the tab forced into the bark pocket. Over 500 trees have been treated in this manner and results show that pine trees up to four or five inches in diameter and from 15 to 30 feet high may be killed with only one tab. However, if the top is limby and there are many heavy branches, it is much safer to insert one or two more tabs since the time involved is only a matter of a few seconds.

Hardwood trees may be killed by using the same method. However, because of the irregular branching habits of hardwoods with the tendency to form spreading crowns, it is necessary to use more insertions per tree than is the case with pine. Another difference between hardwood and softwood trees is that the soft woods can be treated throughout the year, while the bark on hardwoods becomes so tight that it is not possible to make satisfactory bark pockets except during the normal peeling season (roughly from late May to early August).

Trees treated in this manner usually show wilted foilage in a few days and dead crowns within a month.

L. C. Swain

OTHER ACTIVE PROJECTS

Utilization of Low Grade Wood. — L. C. Swain

Possibilities of Propagating High Sugar-Producing Types of Sugar Maples. — C. L. Stevens, S. Dunn

The Characteristics of Sap Flow. — C. L. Stevens

Reproduction Studies. — C. L. Stevens

A Study of White Pine Stands. — H. B. Kriebel

Inheritance of Insect Resistance in Eastern White Pine — H. B. Kriebel

Fruits

(See Horticulture)

Horticulture

Varieties of Tree Fruits That Hold the Spotlight.

The following varieties of winter apples yielded well at the Horticultural Farm and were held in good saleable condition in common cold storage until May. Idared, Redwell, and Fireside are red or red-striped varieties of good quality and appearance that should be planted on a limited scale for further testing elsewhere in the state. Crescent has been our highest quality yellow plum and is very hardy. Redcoat plum has developed ex-

cellent trees and was heavily loaded with fruit even in the West Stewartstown orchard in northern New Hampshire. The demand for sour cherries of the Montmorency variety, or strains of it, and of Belle Magnifique, a sweet-sour cross, have far exceeded the local supply. It appears that the sour cherry might be grown profitably on suitable locations in the southern part of New Hampshire.

R. Eggert

Fruits for Northern New Hampshire Are in Prospect.

An experimental plot consisting of 19 apple, 21 plum, four pears, one apricot, and one cherry variety was established some time ago on the County Farm at West Stewartstown, New Hampshire, to test these varieties for winter hardiness and production. Korean and Nanking cherries were planted at a later date. In February, 1948, a minimum temperature of -41°F. was recorded at the nearest weather station. That winter a few trees were killed, and the presence of blackheart now shows that many kinds were injured.

The varieties uninjured during any winter to date are the Patten pear; Compass, Brooks, Splendid, Black Beauty, Dura Minnesota No. 101, Pembina, and Redcoat plums; Piotosh, Dolgo, Redwell, Whitney, Wealthy, Florence, Cortland, and Haralson apples.

Least promising because of severe winter injury or winter killing are Clapp's Favorite pear; Scout apricot; Bounty, Superior, Mt. Royal, South Dakota No. 27745, Pipestone, Stanley, Lombard, and Abundance plums; Minjon, Anoka, and McIntosh apples.

The Korean and Nanking cherries show varying degrees of hardiness. Korean cherries No. 20 and No. 57 show the least and No. 60 and No. 99 the most winter injury.

Of these fruits most resistant to winter injury, Compass plum had a heavy load of fruit. Others, resistant to winter troubles and making good development of new wood, were Pembina, Tecumseh, Redcoat, and Dura, which had a few plums developing. Black Beauty was vigorous, but without fruit.

Although Opata plum showed some sign of winter injury, its growth was vigorous, and it bore a heavy crop of fruit.

Among the apples, those showing no winter injury and making good growth were Piotosh, Wealthy, Cortland, Red River, Red Duchess, Redwell, Dolgo, and Whitney. Dolgo, in addition, bore a good crop of fruit. In spite of winter injury, McIntosh and Beacon were making very good growth.

The Patten pear was the only one making vigorous growth.

The Scout apricot is of no value.

Montmorency cherry has suffered winter injury but was making good growth and produced a few fruits.

L. P. Latimer, A. F. Yeager

Grape Vines Should Be in Every Home Garden.

For a number of years grape varieties have been under tests at the Horticulture Farm. It is necessary to continue observations until after a "test winter" to determine the hardiness of the varieties.

Van Buren has been outstanding, producing good crops annually and withstanding a temperature of 30°F. below zero. It is an excellent blue variety for making grape juice. Fredonia produced fancy clusters, has proven

resistant to low temperature, and yields a moderate crop of good quality blue fruit. Kendaia (blue) is very vigorous in growth and is winter-hardy, but it is not so dependable for fruit production. The fruit clusters are very large and the berries are of the highest quality. Ontario is an early white grape of high quality and proven hardiness. Seneca and Buffalo produce grapes of highest quality but are not recommended for New Hampshire; the former being quite unfruitful and the latter showing more or less vine injury every winter. Brockton is a fancy white grape but seldom ripens its fruit before fall frosts. For northern sections, Beta is recommended.

L. P. Latimer

Pear Breeding.

Clapp's Favorite, Gorham, and Bosc are among the best of the old varieties. Among seedlings produced by crossing Clapp's Favorite with Conference, two have been selected for wider testing. These have high quality and good size, and they store well.

A. F. Yeager, E. M. Meader

Late-Ripening Strawberries Selected.

A pistillate (or imperfect) flowered strawberry selection, New Hampshire No. 179 (Tupper x Fairfax), was pollinated by Fairpeake variety. From this cross, two attractive, perfect-flowered, large-fruited selections have been made and are being increased for further testing. Both start to ripen their first berries ten days after the popular variety, Howard 17, and they should help to extend the season for ripe fresh strawberries.

E. M. Meader

Grape Breeding.

An original planting of 1500 seedlings of Erie grape has been reduced to 74 selections by roguing and by eliminating unproductive plants and those with imperfect flowers.

A. F. Yeager, E. M. Meader

Peach Breeding.

Selections are being made for a wider test from an F_2 population of a cross between Eclipse and North Caucasus peach. These selections have borne early, yellow, free-stone fruits in abundance in the same year in which Elberta and Golden Jubilee blossoms have been winter-killed.

A. F. Yeager, E. M. Meader

Rubus Breeding.

Many new species of raspberry and blackberry have been procured and crossed with our cultivated varieties. In many instances, these give sterile plants; however, some are fertile. Continued breeding will be needed to perfect varieties from these crosses, but there is evidence that valuable varieties for use in New Hampshire will be discovered. Early-bearing varieties which are winter hardy and which have high production records are being sought.

A. F. Yeager, E. M. Meader

A New Strawberry Variety.

A strawberry seedling resulting from a cross made between New Hampshire No. 94 (Simcoe x Pathfinder) and New Hampshire No. 77 (Tupper x Fairfax) has been named Blaze. This seedling was selected as outstanding for its high yield, very attractive lively-red color, good flavor, and vigor. In season Blaze is five to seven days later than Howard 17 and is recommended for the home garden and local markets.

L. P. Latimer

Sawdust Added to Soil Has Not Increased Yields.

A three-year test to determine the effect of sawdust on the yields of some small fruits and vegetables has indicated that sawdust, even when large amount of additional manure and nitrogen are added, does not increase yields of beans, corn, tomatoes, melons, carrots, peas, squash, strawberries, and raspberries. Over a period of three years more than twice as much manure and fertilizer was used on soil plots to which three inches of sawdust had been added. In most cases, yields were depressed on these plots compared with those from soil plots that received only manure and fertilizer. Acidity of the soil was not affected by the sawdust.

R. Eggert

Mowing Orchard Cover Conserves Moisture.

A group of five uniform grass plots, each 10 feet square, were replicated five times in different parts of the orchard at the Horticulture Farm near Durham. All plots were fertilized uniformly with ammonium nitrate. One plot was not mowed, two were mowed once, and two were mowed twice. Mulch was removed after each mowing from one of each of the latter two groups. A careful check of the percentage of available moisture from May to November was made by means of the Bouyoucos Bridge and plaster of paris resistance blocks. Results show that the greatest amount of available moisture was present at 12 inches and at 30 inches deep in soil of the plots which were mowed twice and on which mulch was permitted to lie. Unmowed plots nearly reached the wilting point at the time grass was in bloom at both 12 and 30 inches. Moisture supply was not replenished until heavy rains in September.

R. Eggert

Deer Damage.

Controlled experiments have shown that the deer prefers apple tree foliage to that of other trees at certain times of the year. They have also shown that certain sprays have made the foliage more palatable. Apparently the deer was after salt in the sprays, because when a salt lick was supplied, it browsed less on the trees. It seemed to browse the trees in the following order: (1) all the terminal leaves, (2) the older leaves of the terminal shoots, and (3) the terminal twigs.

W. W. Smith

Durham Raspberry Culture.

The potentialities of Durham raspberry culture and the best way to grow them are being investigated. Clean cultivation has given the earliest fall

crop and heaviest production as compared to hay, sawdust, and bark mulches. With this variety in most sections, the fall crop is the more important.

A. F. Yeager, W. J. Lord

High Ascorbic Acid Tomatoes.

A final selection is being made through the cooperation of the North Dakota Experiment Station for a tomato desirable in size, color, and flavor but having double the ascorbic acid content of common varieties. Seed of this should be distributed in 1953.

A. F. Yeager

Carrot Breeding.

A good flavored, productive, orange carrot similar in shape to Chantenay but more elongated is being sought. The most promising line has come from crosses between Hutchinson and Morse's Bunching.

A. F. Yeager

Sweeter Table Beets.

Taste panels have been found to prefer sugar beets if they cannot see the white color. From crosses between table beets and sugar beets, strains are being purified which are as sweet as sugar beets while ranking with the good red table beets in color.

A. F. Yeager

Breeding Snap Beans.

A variety of snap beans which will be white-seeded, green-podded, and stringless is the aim of this project. Several of the selections are being given tests in other locations to determine their possibilities as varieties worthy of introduction.

A. F. Yeager, E. M. Meader

Chinese Cabbage, Cabbage, and Rutabaga Combined.

Crosses were made between chinese cabbage and ordinary cabbage in an attempt to combine plant salad characteristics. Pollen of red cabbage was used, whereas the chinese cabbage served as the mother parent. Some young seedlings from the chinese cabbage seed planted showed red color in their stems and proved to be F_1 hybrids. Six of these F_1 hybrids observed proved sterile. Stem cuttings from them were rooted in sand and later treated with colchicine. Some seeds were matured on the F_1 plants that had been treated with colchicine, and they apparently had a doubled chromosome number. The plants grown from these seeds on flowering, however, also proved sterile.

The thought occured that the chinese cabbage x cabbage F_1 plants that had a doubled chromosome number were similar in the chromosome number to the rutabaga, which has 36 chromosomes. Crosses were readily obtained, and plants were secured that combined the three species. These plants grew vigorously and when interpollinated set seeds freely, though some individual plants were self-unfruitful. The generation of plants from seeds matured on the three-species hybrids is being observed in the field during the summer of 1952.

Considerable segregation is taking place. Some plants tend to make swollen roots. Others have no noticeable root swelling, but they produce much foliage. Some plants also have much thickened, succulent leaf stems. Thus there is opportunity to select plants for root characters and for any desirable foliage or leaf stem characters.

E. M. Meader, A. F. Yeager

Phosphorus Needed for Quality Lettuce.

In northern New Hampshire, heavy application of superphosphate combined with moderate application of nitrogen resulted in the highest percentage of marketable heads. Increasing nitrogen applications reduced the percentage cut due to increased softness or failure to head properly, unless phosphorus was also increased to balance the increased nitrogen application. One ton of lime per acre was sufficient to adjust the soil pH. Doubling or trebling the lime application produced no further change in pH.

L. P. Latimer, R. Paulson

Beneficial Effects of Hay Mulch.

Hay used as a surface mulch continues to prevent leaf scorch on McIntosh apple trees, as contrasted with the inability of sawdust to control this disorder. McIntosh and Northern Spy trees mulched with hay continue to outyield trees grown in sod and fertilized with ammonium nitrate. The use of ammonium nitrate during the last four years has not altered this effect.

Young Clapp's Favorite, Bosc, and Gorham pears growing on a shallow, dry soil and mulched with hay have made much better growth than unmulched trees. In a block of Northern Spy trees, fertilization of hay mulched trees with superphosphate plus muriate of potash has, during 1950-51, depressed the yield as compared to hay mulch without additional fertilizer. With the addition of ammonium nitrate to this formula, the yield equalled that of trees mulched with hay but not fertilized. The amount of red color on the fruit at harvest time was the greatest with mulched trees fertilized with superphosphate and muriate of potash, apparently because this treatment hastened maturity of the fruit. The least amount of red surface color and the deepest green ground color at the time of harvest occured in all cases where nitrogenous fertilizer was used. The advantage of the mulch without fertilizer was the improvement of fruit color without any sacrifice of yield.

L. P. Latimer, R. Eggert
G. P. Percival, S. Dunn

Radioactive Phosphorus Is a Tool for Testing Uptake of Phosphorus Fertilizer by Apple Trees.

Phosphorus fertilizers appear to be fixed by New Hampshire soils to such an extent that many growing plants can get only a small fraction of that fertilizer or none at all. The question arose as to whether apple trees, because of that action, fail to give more response to phosphorus fertilizers because they do not need more of the element or because they cannot get it. Phosphorus fertilizers tagged with radioactive phosphorus were applied as foliar sprays and to the soil to compare the uptake of the element from both sources. The first experiments under both greenhouse and field conditions show that

phosphorus can be absorbed by the leaves and translocated to other parts of the tree and fruit. Tests are now under way to determine whether foliar applications of that material are beneficial to the trees or fruit under normal orchard conditions.

R. Eggert, L. T. Kardos

Storage of Butternut Squash.

A material known as VL600 continues to store butternut squash with less shriveling and decay. Approval of the Pure Food Department must be secured before using it on squash which are to be sold. At the present time, there is no apparent reason why this approval should not be forthcoming.

A. F. Yeager

Frozen Blueberries Vary in Quality.

Five commercial varieties of highbush blueberries were picked at intervals of one week. Fruit from each picking and of each variety was poured directly into tin cans and into cardboard-pliofilm freezer cartons. Carbon dioxide at normal pressure was also added to some of the fruit in tin containers. All containers were sealed without addition of syrup, sugar, or water, were frozen immediately, and were held at 0°F. After one year, a taste panel of fifteen people indicated that fruit processed in tin was less tough-skinned than that frozen in other containers. Carbon dioxide added to fruit in tin cans did not decrease its skin-toughness and did produce a product of inferior quality. Results also indicate that if skin of fruit is tough at the time of freezing, then processing it in tin will not decrease that toughness.

R. Eggert

Fertilizers for Blueberries.

Results of many fertilized plots in several lowbush blueberry areas in New Hampshire indicate that the yield of blueberries can be doubled, especially in fields that have been in production for many years. However, the primary object of fertilizing lowbush blueberries has been to invigorate the blueberry plants and the accompanying grass to make fuel for fire so that the area can be burned. We believe fertilizing grass to produce fuel for burning is more practical than using oil or hay because it increases fruit production at the same time.

Good results have been obtained with ammonium sulphate at the rate of 300 lbs. to the acre. A 10-10-10 at 700 lbs. per acre has been used. Nitroprills is now being tested because it is easy to apply and because of its concentration of nitrogen. This concentration makes it more economical to carry up the hills. For best results, fertilizer should be applied in the early spring before plant growth starts.

In the case of highbush blueberies, best results have been obtained by applying ammonium sulfate at weekly intervals during May and June. Nugreen applied as a soil fertilizer has given excellent results in the blueberry nursery. Since highbush blueberry roots are shallow, care must be taken not to apply fertilizer in bunches, for it is easy to kill the plant. The fertilizer should be spread very thin.

W. W. Smith

Dusting Lowbush Blueberries.

Dusting lowbush blueberries to control the blueberry fruit fly has become a "must" with growers. The first application of calcium arsenate is applied when 5 percent of the blueberries are blue and should be repeated every 10 days until harvest at the rate of 6-10 lbs. per acre. Many growers are finding it profitable to dust with DDT in the spring before bloom, and immediately following bloom, to control leaf-chewing and leaf-sucking insects.

W. W. Smith

Weed Control in Blueberry Fields.

Most growers are using chemicals for controlling weeds in their blueberry fields. 2-4-5T with kerosene at the rate of one pint of 2-4-5T to four gallons of kerosene is being used for stump and basal applications. Foliar spray of the Amine forms of 2-4D in concentration of 500 parts per million of 2-4D in water has been found effective on sweet fern and hardhack without injuring the blueberry plants.

W. W. Smith

Aluminum Wrappers Reflect Heat in Apple Trees.

The temperature of the cambium layer on the south side of apple tree trunks exposed to direct sunlight in winter has been shown to reach 70° to 80°F. on days when air temperature was only 32°F. Wrapping the trunks of the trees with alumnium foil and painting them white are practices that have reduced greatly the absorption of heat at that season. In order to determine whether this practice will prevent winter injury, a large number of tree trunks are being wrapped with alumnium foil each fall to determine whether cooling the trunk will harden it, thus preventing crown splitting, as well as direct injury during winter caused by rapid changes in trunk temperature.

R. Eggert

Rootstocks for Apple Trees.

After several years of experimenting with rootstocks and interstocks, it is now determined that Robusta No. 5 on its own root is the most promising body stock we have for apples in New Hampshire. Malling 1 appears to be the most promising as a semi-dwarfing root for our varieties. Malling 7 has not been tested thoroughly, but it also looks promising. Malling 9 seems to be most suited for ornamental and backyard trees.

W. W. Smith

A New Pot Plant for Florists.

The tall dark yellow pot calla lily *(Z. elliottiana)* has taken on a "new look" at the University of New Hampshire. When hybridized with the tiny, pink-flowered, strap-leaved calla *(Z. rehmanii)*, three new types have been produced. These are low-growing, making good pot plants. One has attractive arrow-shaped leaves and small white flowers. Another has dark green leaves with white spots and attractive pale yellow flowers. The third has small pinkish yellow flowers and dull green leaves. Further variations are expected among the offspring of these hybrid callas.

E. B. Risley

New Hardy Rambler Roses for All of New Hampshire.

New hardy rambler roses for all of New Hampshire is the goal of the rose breeding experiments at the University of New Hampshire. From far northern Manitoba, Canada, have come several roses capable of surviving the winters there. Temperatures often remaining as low as -50°F. for weeks have proven the hardiness of these plants in Canada. Without any form of winter protection, these roses alone survived the winter of 1951-52 in the University of New Hampshire rose garden at Durham. These far northern roses have pink flowers. Most are single flowered and "wild" in appearance. One is a rampant rambler and the others are bush types, both dwarf and tall. The Red Leaf Rose makes a handsome landscape plant in itself.

These hardy northerners are being hybridized with the prize winning varieties of hybrid tea roses and ramblers which we all like but cannot grow in most of New England because of the very low winter temperatures. Some time may elapse before hardiness and "high quality" may be mated successfully, but the offspring will be well worth waiting for.

E. B. Risley

Inbred Gladiolus.

The gladiolus is one popular flower that can always be depended upon to grow well in New Hampshire gardens with reasonable care. Available varieties of glads do have their weak points, however. Many are very susceptible to ravages of disease; some have weak, brittle, and crooked spikes; others produce too few flowers per plant; and hardly any emit noticeable fragrance. Present-day varieties are complex hybrids and when further hybridized seldom yield superior offspring. Thus our problem is that of producing parent varieties capable of producing tomorrow's superior offspring.

The procedure is similar to that used in producing hybrid corn varieties so familiar to everyone today. For example, a variety having a weak but pleasing fragrance and little ability to pass that fragrance on to its offspring is self-pollinated or inbred. This intensifies both the fragrance and the ability of some of its seedlings to transmit that quality. After a few generations of inbreeding, we have a variety that will pass pleasing fragrance on to all of its offspring. Then and only then can we mate "fragrance" with other desirable traits from other glads and be confident of producing new and better flowers for tomorrow.

Visitors to the University of New Hampshire Horticulture Farm may see this work in progress.

E. B. Risley

Low Stature Lilac for Home Planting.

A lilac grown at Durham from seeds collected in Korea holds promise for a low-growth shrub for home grounds with limited space. The plants grow to be four feet tall and has a compact growth habit. The highly fragrant light purple flowers are borne in large clusters that blossom late after other common varieties have finished flowering. The dark green leaves with a distinctly wavy conformation have remained free of mildew. The lilac has been propagated readily by softwood cuttings.

E. M. Meader

Improved Hazel Production.

It has been determined that the most easily grown and the most productive nuts at Durham, New Hampshire, are the filbert hazel hybrids. Few of these are available from nurseries. One which is listed by some and which has given very good crops is Bixby.

A. F. Yeager

Korean Chestnuts Prove Hardy and Fruitful.

Precocious chestnut trees grown from nuts collected in Korea in 1947 are producing their third crop of nuts at Durham in 1952. A few seedling trees were injured by cold during the winter of 1951-52, and the less hardy ones have been removed. The hardy Korean chestnuts may help to replace the American chestnut which was lost for the most part because of the chestnut blight. Three seedlings of American chestnut were grown from nuts matured on a tree in Newbury, New Hampshire, that had escaped the blight. Though the American chestnut seedlings have grown taller than the Korean trees of the same age beside which they are growing, there is no hope for them; all three have now blighted. They can only serve as a source of the disease for testing the resistance of the nearby Korean chestnuts.

E. M. Meader, A. F. Yeager

Marketing

(See Agricultural Economics)

Pastures

(See Agronomy)

Plant Pathology

(See Botany)

Poultry Husbandry

Methionine May Improve Feed Efficiency.

Within the last two years much interest has developed in the poultry industry in supplementation of starting and broiler feeds with the amino acid methionine. This interest has developed because of the shortage and high price of methionine-rich animal proteins such as fishmeal. Calculations and certain experiments indicate methionine can be the first growth limiting amino acid in practical poultry rations. Also during this same period of time the chemical industry has produced methionine in quantity and at a price which warrants consideration of its use. The question now relates to what improved results can be obtained with methionine and the economics involved.

Two strains of New Hampshire male broiler chicks were used in feeding experiments with methionine. Three experiments were run at different seasons of the year. Each ration studied was fed to a total of five lots of chicks during the course of the three experiments. Methionine was added to the ration at the rate of two pounds per ton.

When methionine was added to a good starter broiler ration containing four percent of fishmeal no improvement in growth resulted. However, feed

efficiency was improved to slight significance. Economically this ration supplemented with methionine is not feasible because the level of methionine used was too high. It is possible that a lower level of methionine may give the same results and be feasible economically.

R. C. Ringrose, L. M. Potter

High Efficiency Feeds Satisfactory for Breeders.

It is generally conceded that the use of a "high efficiency" or "high energy" feed for broilers results in the most profit. Yet when feeds incorporating the same principles are offered to poultrymen for laying birds there is some reluctance to use them. During the past year five experimental high efficiency type feeds have been studied in comparison with a standard type feed for breeding birds during a period of eight months.

On each of the high efficiency rations egg production was better than with the standard type ration. The increase in production ranged from 12 to 27 percent. With the standard type ration it required 7.43 pounds of feed to produce a dozen eggs. Feed efficiency for the high efficiency rations also was improved and varied between 5.98 and 6.91 pounds per dozen eggs. This represents an average decrease of 13 percent in feed required to produce a dozen eggs. If one assumes a feed cost of five cents per pound, then feed cost per dozen eggs was reduced from 2½ to 7½ cents per dozen depending upon the ration selected to use.

There were differences in hatchability of the eggs produced on the various rations. Since the number of hatches was small they are of doubtful significance. No ration gave a hatchability below 73 percent.

R. C. Ringrose, L. M. Potter

How Much Protein for Egg Production with Meat-Type New Hampshires?

It is the feeling of some poultrymen that meat-type New Hampshire hens require more protein for egg production than do production strains of New Hampshires. This belief is probably based on the fact that the meat strains are considerably larger and heavier birds than are the egg strains.

In an experiment of eight months duration levels of fifteen and eighteen percent protein were fed to duplicate pens of meat-type New Hampshires. In addition another set of duplicate pens were alternated from fifteen to eighteen to fifteen, etc., percent protein every four weeks.

No significant differences developed between the pens. The small differences that did occur were mostly in favor of the fifteen percent protein level. This is the level recommended and in widespread usage today.

	Protein		
	15%	18%	Alternating 15% and 18%
Percent production	62.5	60.2	62.0
Feed per dozen eggs, lbs.	6.03	6.36	6.25
Weight gain, lbs.	.86	.70	.56
Hatchability, percent	73.5	74.5	82.1

R. C. Ringrose, L. M. Potter

Restricted Feeding on Range May Not Be Best Practice.

Many poultrymen are now practicing restricted feeding of growing pullets on range. This practice is followed with the idea that the pullets will eat more grass resulting in feed savings and lower costs. Care must be used in following such a program, since savings made on range may be lost in the laying house.

When feed of one group of pullets was restricted 22 percent on an average to good grass range, a feed saving of 3.25 pounds resulted between 12 and 20 weeks of age. This feed was worth sixteen cents per bird. However, these pullets averaged .47 pounds less in weight than the check group. After 12 weeks in the laying house on a full feeding program both groups of pullets weighted the same. But the pullets grown on the restricted feed program had consumed .2 pounds more feed per bird and had laid four less eggs per bird. The economic value of the loss in egg production amounted to slightly more per bird than the value of the feed saved on range. Thus it is evident that savings made in range feeding were lost in the laying house through increased feed consumption and lowered egg production.

R. C. Ringrose, L. M. Potter

Breeding for Meat and Eggs in the Same Bird.

A Dark Cornish-New Hampshire cross made at this Station ten years ago resulted in what is now called the Durham breed. Of the trapnested hens which have finished their laying year the highest production is 252 eggs. Twenty-two percent of the hens used as breeders this season hatched 90 percent or more of fertile eggs. The average fertility of all eggs set was 85 percent.

At twelve weeks of age, offspring of Durham males mated with New Hampshire females were similar in weight, but superior in width of breast and in livability to straight New Hampshires, also produced from flock matings. Reciprocal crosses of Durhams and New Hampshires in which the cross-bred and pure-bred chicks were produced simultaneously by the same sires are now being studied. This test will provide an accurate comparison of the pure strains, and of the crosses with each of the pure strains. Preliminary results indicate that the crosses are heavier than either pure breed. Feed efficiency for growth and body conformation measurements of the pure breeds vs. the crosses are also being compared in this test.

Succeeding generations of the offspring resulting from crossing White Cornish and New Hampshires in 1948 have been improved and are now called White Durhams. Egg production, fertility, and hatchability is not as high as in Durhams but one trapnested hen which has just completed her laying year laid 217 eggs. Individuals range in color from red with white showing only in portions of the wings and tail, to almost completely white. The under color is white. Progress has been made this year in increasing the proportion of individuals in the flock which are nearly white.

Twelve-week-old crosses of White Durham males on New Hampshire females were slightly inferior in livability, but were heavier, and possessed greater breast width than straight New Hampshires. A test to compare the growth, feed efficiency, and conformation of White Durham, New Hampshires, and their reciprocal crosses is planned.

W. M. Collins

The Value of Crossing Strains of New Hampshires for Broiler Production.

Five strains of New Hampshires were studied to determine whether cross-strain progency are superior to pure-strain progeny in certain broiler characteristics to ten weeks of age. The following crosses were made:

Meat type x meat type
Meat type x dual purpose
Meat type x egg type
Dual purpose x dual purpose
Dual purpose x egg type

In each of the five matings, males of one strain were mated concurrently with females of the same strain and with females of a different strain. This technique made it possible to produce simultaneously pure-strain and cross-strain progeny. The cross-strain progeny were half brothers — half sisters to the pure-strain progeny. A total of 751 chicks were produced from these matings.

Preliminary results show that fertility averaged 7.5 percent and hatchability 4.6 percent higher among the cross strains than among the pure strains. Rate of growth of the cross-strains progeny was superior to that of the pure-strain offspring when the two meat-type strains were mated together, but in no other matings. The failure to obtain a "kick" in growth (with one exception) may be due in part to the rather large differences in adult size of the birds among some of the types of matings.

Cross-strain progeny consumed their feed more efficiently than pure-strain progeny from the same mating in three out of the five matings. This was true even though two of these three groups cross-strain progeny grew at a slower rate than their pure-strain half siblings. Cross-strain and pure-strain progeny from one of the remaining matings were similar in feed efficiency and in the other mating were less efficient in converting feed to meat.

Cross-strain offspring showed no consistent superiority over the pure-strain progeny in width of breast. Losses due to mortality during the ten-week growth period were approximately the same in the two kinds of offspring.

This project will be continued another year with some different strains. and reciprocal matings will be made.

W. M. Collins

Problems Involved in the Vaccination of Infectious Bronchitis.

During the past year a survey of the existing vaccination program for the last two years was made. The information was compiled on a yearly basis presenting some factual evidence as to the actual problems and their existence throughout the state. The first year 261 questionnaires and the second year 169 questionnaires were returned. This involved some 780,224 birds the first year and 321,992 the second year.

In both instances it was found that the greatest number of birds was inoculated from 4 to 8 weeks. It appeared the problems of infectious bronchitis inoculation were greater in the fall and winter months. In regard to the age of the birds the greater success was attained in the birds which were inoculated 8 weeks and over.

Complications which sometime follow infectious bronchitis inoculations were in greater number in the fall and winter months. The average length of time of respiratory symptoms in the year 1950 was 26 days as compared to 18 days in 1951. While this may be affected by the total number of birds, it is interesting to note. The mortality following vaccination in 1950 was 2.02 percent as compared to 2.20 percent in 1951. The mortality is based on field observations without recourse to laboratory findings. This indicates the vaccination program as a whole is reasonably satisfactory. But it is the individual flocks which have the problems of infectious bronchitis vaccination.

In an effort to find out if some immediate control could be given to bring relief from some of these cases, two drugs were tried — iodine and antihistamine. These were administered in the water at various times and levels, both when the respiratory symptoms appeared and before they appeared.

Finally, antihistamine was given in the vaccine when administered. In no instance could any value be dervied from the drugs in controlling untoward reactions.

W. R. Dunlop

Is It Possible for Chicks Under Four Weeks to be Vaccinated by the Wing Web Modified Live Virus Newcastle Vaccine?

Contrary to earlier knowledge, this appears to be possible in parentally immune chicks. On experimental trial, groups of birds were made up from range-reared stock which were vaccinated at 14 weeks of age by the wing web method. At 24 weeks one group was revaccinated by the modified live virus wing web method.

Following inoculation, eggs were saved from both groups for a period of 11 days. One half of the eggs from the revaccinated group were selected for virus isolation. In no case was the virus of Newcastle disease recovered. The remaining eggs of the revaccinated group and those of the group vaccinated once were incubated. It was demonstrated that the difference in total infertile eggs was slight. However, the difference in dead germs and the percentage hatch appeared significant, the revaccinated birds having the greater percentage of dead germs and the lower hatchability. After hatching, all chicks were placed in isolated groups for vaccination at one day of age and seven days of age. Under isolated conditions, as described, they all survived vaccination with the modified live virus wing web Newcastle vaccine.

Therefore, under these conditions, from the limited scope of this experiment, there are indications suggesting the possibility of vaccinating chicks under 4 weeks having parental immunity with the Newcastle modified live virus wing web vaccine without anticipating too great a mortality.

W. R. Dunlop

Artifical Light Delays Pullet Maturity.

The common complaint that replacement chicks hatched in the fall mature early and lay more small eggs can now be overcome by proper application of artificial light. The reason that light is effective is that it is applied during the entire growing period. Used during the fall and winter period of short days, the light voids the stimulation normally provided in the spring by the increase in natural daylight. It is this increase in natural daylight as the pullets approach maturity that causes the early sexual maturity and resulting small egg size.

Two years work with a fall hatch each year gave results that checked closely. When the lights are started with the day-old chicks and continued into the late spring, one can expect about two weeks delay in maturity. The lights should be continued in the spring until the last of April. One can also expect a larger egg size. Up to a fifty percent production level, the increase in egg size is sufficient to make about one third of the eggs grade into the next higher weight class. Experimentally both an all night light (dim, 1 watt to ten square feet) and fourteen hours of light (bright, 1 watt per four square feet) were used with essentially the same results.

Based on the results from one year's work, an attempt to delay maturity of fall hatches by using a special feed and restricting feed on a time basis was without effect.

R. C. Ringrose, L. M. Potter

Abnormal (Bulging) Eye in New Hampshires.

An abnormal type eye has been found in a certain line of the Station New Hampshires. The area behind the pupil in such an eye appears to fill with excess liquid, thus causing the bulging appearance. Affected birds may exhibit frequent shaking of the head, and the sight may seem to be partially affected.

The character is being studied to determine its mode of inheritance.

W. M. Collins

The Effect of Frequency of Gathering Eggs From the Nest on Hatchability.

A controlled study was made at the University of New Hampshire Poultry Farm in order to obtain hatchability records on a seasonal basis from eggs that had been collected from the nest one, two, three, and four times daily. Collections were made during the months of November, February, April, and July, as it was felt that these months were typical of their respective seasons.

Collections were made at the arbitrarily selected hours of 8 and 11 in the morning and at 1 and 4 in the afternoon. When eggs were collected once daily they were picked up at 4:00 p.m.; twice daily at 11:00 a.m., and 4:00 p.m.; three times daily at 8:00 and 11:00 a.m. and 4:00 p.m. and four times daily at 8:00 a.m., 11:00 a.m., 1:00 p.m., and 4:00 p.m. Control eggs for each collection trial were collected hourly during the day either preceding or succeeding the experimental trial.

Although pen temperatures varied from a winter average of 37°F. to 78°F. during midsummer, no significant differences in hatchability occurred as a result of more frequent egg collections. All results were inconsistent in relation to the frequency of egg collections and in no case were differences significant even when eggs were held 14 days prior to incubation.

In addition, a field survey was made covering approximately forty-five farms throughout southeastern New Hampshire and eastern Maine, in order to obtain first-hand information as to the frequency of egg collections practiced by commercial poultry breeders. This study revealed no farms that were collecting eggs four times daily but 52 percent of them collected three times daily throughout the year and more often during severe weather conditions; 41 percent collected eggs only three times daily; five percent collected eggs two times daily and often three times daily during very cold or hot weather, while another two percent collected eggs only twice daily.

Hatchability results indicated no significant differences between the frequencies of gathering eggs from the nest. In fact, eggs that were collected twice daily produced hatchability results equal to that produced from eggs collected more frequently; this same pattern held true throughout the four seasons.

This work indicates that frequency of gathering eggs on the farm has no effect on hatchability.

W. C. Skoglund, A. L. Brown

Intensity of Artificial Illumination and Its Effect upon Production in Meat-Type New Hampshires.

Many laying pens are poorly illuminated, the bulbs being of low voltage and covered with dust. Some of the recommendations now state that a light meter reading of at least two candle foot on the feeders is necessary and it is doubtful whether the commonly used 40 or 60 watt bulbs will do this.

An experiment was set up using January hatched New Hampshire pullets using *no lights*, *50 watt bulb* (1 watt per 4 square feet), *100 watt bulb* (two watts per four square feet), and *200 watt bulb* (4 watts per four square feet). Records were obtained for 296 days production July 10, 1951, to May 1, 1952.

Light Intensity	Eggs Per Hen	Percent Production	Pounds of Feed Per Hen
No lights	154.10	52.06	96.99
50-watt bulb (1 watt per 4 sq. ft.)	172.70	58.34	100.44
100-watt bulb (2 watts per 4 sq. ft.)	171.99	58.10	99.45
200-watt bulb (4 watts per 4 sq. ft.)	178.10	60.17	105.44

There appeared to be a tendency for the 200 watt bulb pen to have resulted in a somewhat higher rate of production, but that it did not appear economical.

W. C. Skoglund

OTHER ACTIVE PROJECTS

Choline in the Nutrition of Poultry.

R. C. Ringrose, H. A. Davis

The Inheritance of Feed Utilization Efficency in Poultry.

W. M. Collins

Soils

(See Agronomy)

Vegetables

(See Horticulture)

State Services

Seed Inspection.

The regular seed inspection work for the State Department of Agriculture was conducted as usual. During the year, 2273 samples were handled

in the laboratory. Of this number, 690 samples were collected by the state inspectors and will be reported in Station Bulletin 396; 1583 samples were sent in by seed dealers in compliance with the clause in the New Hampshire seed law which requires that all vegetable and agricultural seed must have been tested for germination within nine months of being offered for sale. Therefore, much of this testing was seed carried over from the previous season. A few of these samples were sent in by farmers who had grown beans, squash, muskmelon, or rye and wished to sell it for seed.

General referee testing has been conducted on samples sent from a central source to all official seed testing laboratories, while regional referee samples were sent out again this year from our laboratory to the thirteen official laboratories in the country — sometimes to compare the interpretations of the cooperating laboratories, sometimes to obtain a large number of figures from which to arrive at standards for various seeds, and sometimes to gain the benefit of having many laboratories work on a new problem such as the germination of pelleted seed or the handling of treated seed.

Bessie Sanborn

Inspection of Commercial Fertilizers — 1951.

A total of 114 samples of mixed fertilizers and fertilizer materials, representing products of twenty manufacturers, was submitted to the laboratory by the Control Supervisor of the Department of Agriculture for analysis. Of this number sixty-eight represented complete fertilizers, ten phosphoric acid and potash, and the balance represented single-ingredient fertilizer materials.

Of the 114 brands sampled, sixty-four equalled or exceeded all guarantees. Deficiencies, when found, were in most cases small and were usually more than offset by over-run in other constituents. The fertilizer should, of course, meet the guarantee on all counts to avoid unbalance in the effect for which it is designed.

Detailed data appears in Bulletin 391, dated September 1951.

H. A. Davis

Inspection of Commercial Feedingstuffs 1951-52.

The control Supervisor of the Department of Agriculture submitted 704 samples, representing products of 125 manufacturers, to the laboratory for analysis during the fiscal year 1951-52. These samples represented all classes of feedingstuffs including cat and dog foods.

Of these samples, 12.7 percent contained less than the guaranteed amount of protein, 8.8 percent less than the guaranteed amount of fat, and 4.3 percent contained crude fiber in excess of the guarantee. These findings compare favorably with those of recent years.

Detailed data appear in Bulletin 393, July 1952.

H. A. Davis

Soil Testing.

During the last fiscal year, 2310 miscellaneous soils have been analyzed for available nutrients and pH value entailing 18,480 individual determinations.

G. P. Percival

The National Poultry Improvement Plan.

The official State Agency for the National Poultry Improvement Plan (NPIP) in this state is the New Hampshire Poultry Improvement Board, Inc. The board consists of ten members elected from and by the poultrymen participating in the various phases of the plan.

The NPIP office administers the breed stages of the plan and is the office of the contact representative for the state who serves as liaison between the state and the U.S.D.A. and heads up the whole program in the state.

Participation in the breed stages (Approved and Certified) involved 419 flocks with 1,337,649 birds. This is 75 percent of the total participation which includes flocks that are in pullorum classes only.

The R.O.P. program has 8 flocks with about seven thousand birds under official trapnesting.

The Meat Production program has four flocks participating. Again this year the chicks for the Meat program are being raised at the University poultry plant and with eight more entries make up the second New Hampshire Broiler Test. The test will run from June 30th to September 8th.

E. T. Bardwell

Diagnostic Services Performed at the Poultry Laboratory.

From July 1, 1951, to June 30, 1952, a total of 5.144 specimens of all kinds were submitted to the Poultry Laboratory for diagnosis. These represented 2,015 cases.

A total of 4,532 chicken specimens were examined, 140 turkeys, and 8 miscellaneous birds. Eighty cases consisting of 112 specimens from various animals were also handled by the Laboratory personnel. There were 352 cases of blood samples submitted for the immunity tests.

A. C. Corbett, d.v.m., W. R. Dunlop, d.v.m.

Pullorum Testing.

Testing of the poultry for pullorum disease in the state of New Hampshire is done by the Poultry Laboratory at the University. During the last fiscal year 1,783,114 birds were tested by means of the tube agglutination test. In addition 56,196 retests were made, thus giving a total of 1,839,310 samples tested for the year.

Of 584 flocks tested 5 were found to harbor infection. Thus 0.85 percent of the flocks under test were infected.

F. E. Allen, d.v.m., A. C. Corbett, d.v.m., W. R. Dunlop, d.v.m.

Infectious Bronchitis Virus.

The Poultry Laboratory grows Infectious Bronchitis virus on embryonating eggs, and after being tested for purity and potency it is sold to poultrymen of the state for inoculation of their susceptible birds The birds upon recovery from the disease have a fairly solid immunity. During the last fiscal year 967 lots of this virus were supplied to New Hampshire poultrymen.

F. E. Allen, d.v.m., A. C. Corbett, d.v.m., W. R. Dunlop, d.v.m.

Differential Diagnosis of Newcastle Disease.

A preliminary study was made on breeders which had been vaccinated by the wing web method for Newcastle Disease at fourteen weeks. The birds

were divided into two groups and one group was revaccinated. Chicks were hatched from each group and found immune on an adequate challenge. Additional chicks were selected from each group and one half were vaccinated with live virus wing web vaccine at two days of age and the others were not vaccinated. Upon challenge at the age of five weeks the chicks were found to possess no immunity.

This experiment was repeated with known susceptible and known immune breeders with identical results. Field checks on 150,000 birds vaccinated as chicks by the modified live virus web vaccine also indicated no immunity at seven weeks.

W. R. Dunlop

Publications

EXPERIMENT STATION BULLETINS

387 *Efficiency in the Dairy Barn.* H. C. Woodworth and K. S. Morrow.

388 *Inspection of Commercial Feedingstuffs.* H. A. Davis and Mary A. Bruce.

389 *Supply and Price Relationships for New Hampshire Fluid Milk Markets.* J. R. Bowring.

390 Results of Seed Tests for 1951. Bessie G. Sanborn.

391 *Inspection of Commercial Fertilizers.* H. A. Davis, Mary A. Bruce, and Elizabeth E. Eastman.

392 *Marketing New Hampshire Hatching Eggs.* L. A. Dougherty, T. B. Charles, and A. M. Atwood.

393 *Inspection of Commercial Feedingstuffs.* H. A. Davis and Elizabeth E. Eastman.

394 *Biennial Report of the Director of the New Hampshire Agricutural Experiment Station.* H. C. Grinnell and M. C. Richards.

395 *Expansion Opportunities for the New Hampshire Poultry Meat Industry. I. The Competitive Position of the Industry.* J. R. Bowring and William H. Wallace.

RESEARCH MIMEOGRAPHS

Dairy Husbandry

2 *The Relative Nutritive Value of Ground and Coarse Textured Concentrates for Dairy Cattle.* N. F. Colovas, H. A. Keener, and H. A. Davis.

OTHER SCIENTIFIC CONTRIBUTIONS

Keener, H. A., Baldwin, R. R., and Percival, G. P. *Cobalt Metabolism Studies with Sheep.* Jour. Animal Sci. 10:1951.

Colovos, N. F., Keener, H. A., Teeri, A. E., and Davis, H. A. *The Effect of Vitamin D on the Utilization of Energy and Protein of the Ration of Calves.* Jour. Dairy Sci. 34: 735-742. 1951.

Teeri, A. E., Josselyn, D., Colovos, N. F., and Keener, H. A. *Influence of the Ration on the Excretion of Certain Vitamins by Ruminants.* Jour. Dairy Sci. 34: 1070-1072. 1951.

Changes In Personnel

Averill, Warren, Assistant Chemist. (September 1, 1951-)
Baker, John R., Graduate Assistant in Botany. (September 1, 1951-)
Bemis, Roscoe H., Assistant Animal Husbandman. (July 1, 1951-June 4, 1952)
Berry, S. Z., Graduate Assistant in Horticulture. (February 1, 1952-)
Boynton, C. Hilton, Associate Dairy Husbandman. (March 1, 1952-)
Collins, Walter M., Poultry Geneticist. (September 5, 1951-)
Dunn, Gerald M., Assistant Agronomist. (September 15, 1951-)
Eastman, Charles E., Graduate Assistant in Agronomy. (July 1, 1950-May 15, 1952)
Eastman, Elizabeth E., Assistant in Agricultural and Biological Chemistry. (July 1, 1951-)
Eastman, M. Gale, Research Assistant in the Agricultural Experiment Station. (January 1, 1950-December 31, 1951)
Frick, George, B. A. E. Cooperator (August 2, 1948-)
Gamble, John F., Graduate Assistant in Agronomy. (September 15, 1951-)
Gibson, Kenneth S., Graduate Assistant in Dairy Husbandry. (September 1, 1951-)
Heald, L. Franklin, Editor. (July 1, 1951-)
Henry, William F., Agricultural Economist. (March 1, 1952-)
Kriebel, Howard, Assistant Forester. (July 1, 1951-)
Langley, Charlotte H., Laboratory Assistant in Bacteriology. (July 5, 1948-June 30, 1950)
Lude, Carl R., Laboratory Technician in Poultry Husbandry. (May 14, 1951-April 1, 1952)

Lyford, Walter, Soil Surveyor, and B.P.I.S.A.E. Cooperator. (July 1, 1949-)
MacDonald, William, Graduate Assistant in Botany (July 1, 1950-May 31, 1951; Research Assistant in Botany, June 1, 1951-)
Marelli, Joseph, Departmental Technician in Bacteriology. (November 1, 1951-)
McConnell, James F., Departmental Technician in Bacteriology. (July 1, 1950-November 3, 1951)
Moore, George R., Graduate Assistant in Agronomy. (July 1, 1950-January 31, 1952)
Moore, W. E. C., Graduate Assistant in Bacteriology. (February 1, 1951-June 30, 1951)
Murphy, Douglas, Research Assistant in Botany. (August 1, 1950-June 30, 1951)
Nast, Charlotte G., Plant Cytologist. (July 1, 1949-)
Olcott, Elizabeth, Laboratory Technician in Agricultural and Biological Chemistry. (September 1, 1950-June 9, 1951)
Paulson, Robert W., Graduate Assistant in Horticulture. (July 1, 1950-August 31, 1951)
Payne, Putnam, Graduate Assistant in Horticulture. (September 1, 1951-)
Potter, Lawrence M., Graduate Assistant in Poultry Husbandry. (July 1, 1951-)
Poulin, Roger A., Plant and Animal Sciences Librarian. (July 1, 1951-)
Rasmussen, E. J., Associate Horticulturist. (January 7, 1947-September 1, 1949)
Reynolds, Harriet, Assistant in Bacteriology. (March 1 1951-June 30, 1951)
Rich, Avery, Plant Pathologist. (September 15, 1951-)
Richardson, Agnes T., Laboratory Assistant in Bacteriology. (July 1, 1950-)
Rines, Bernard P., Associate Agricultural Engineer. (September 1, 1949-)
Scarce, Leroy E., Graduate Assistant in Bacteriology. (September 1, 1949-January 31, 1951)
Schroeder, Sherwood, Graduate Assistant in Bacteriology. (September 1, 1950-June 30, 1952)
Schumacher, W. B., Research Assistant in Agricultural Engineering. (February 1, 1952-June 30, 1952)
Shimer, Helen P., Associate Chemist. (May 17, 1943-August 31, 1951)
Sirotnak, Francis M., Graduate Assistant in Bacteriology. (February 1, 1951-January 31, 1952)
Skoglund, Winthrop C., Poultry Husbandman. (November 6, 1950-)
Smith, R. Dee, Graduate Assistant in Horticulture. (July 1, 1950-June 30, 1952)
Wallace, William H., Graduate Assistant in Agricultural Economics. (September 1, 1949-January 31. 1951)
Van Wijk, Marjan, Laboratory Technician in Agricultural and Biological Chemistry. September 15, 1951-)
Wodarski, Edmund, Graduate Assistant in Bacteriology. (February 1, 1952-)
Wolfe, Leonard, Graduate Assistant in Botany. (September 1 1948-May 31, 1950; Research Assistant in Botany, September 1, 1950-April 30, 1951)
Wright, Frank, Graduate Assistant in Dairy Husbandry. (July 1, 1949-September 30, 1950)

New Hampshire Agricultural Experiment Station Staff

June 30, 1952

Administration

Harold C. Grinnell, ph.d., Director
Mathias C. Richards, ph.d., Associate Director
Russell C. Smith, Purchasing Agent
Walton E. Devine, Assistant Treasurer
L. Franklin Heald, b.a., Publications Editor
Harold Adams, b.s., Assistant Editor for Agriculture and Home Economics
Thelma Brackett, a.b., Librarian
Roger J. Poulin, a.b., b.s.l.s., Library Assistant in Charge, Plant and Animal Sciences Library

Agricultural and Biological Chemistry

Thomas G. Phillips, ph.d., Chemist
Stanley R. Shimer, m.s., Associate Chemist
Gordon P. Percival, m.s., Associate Chemist
Arthur E. Teeri, ph.d., Associate Chemist

Henry A. Davis, m.s., Assistant Chemist
Warren Averill, ph.d., Assistant Chemist
Margaret Loughlin, a.b., Research Assistant in Agricultural and Biological Chemistry
Dorothy Josselyn, Assistant in Agricultural and Biological Chemistry
Elizabeth E. Eastman, b.s., Assistant in Agricultural and Biological Chemistry
Marjan Van Wijk, Laboratory Technician in Agricultural and Biological Chemistry

Agricultural Economics

William F. Henry, m.s., Agricultural Economist
Harry C. Woodworth, m.s., Agricultural Economist
Wilfred K. Burkett, ph.d., Associate Agricultural Economist
James R. Bowring, ph.d., Associate Agricultural Economist
Lawrence A. Dougherty, b.s., Assistant Agricultural Economist
John C. Holmes, a.b., Research Assistant in Agricultural Economics
George Frick, m.s., B.A.E. Cooperator

Agricultural Engineering

Bernard P. Rines, b.s.a.e. and e.e., Associate Agricultural Engineer
Arthur G. Fox, Jr., b.s.a.e., Assistant Agricultural Engineer
Walter B. Schumacher, b.s.a.e., Research Assistant in Agricultural Engineering

Agronomy

*Ford S. Prince, b.s., Agronomist
Leroy J. Higgins, b.s., Associate Agronomist
Louis T. Kardos, ph.d., Associate Agronomist
Paul T. Blood, m.s., Assistant Agronomist
*Reeshon Feuer, b.s., Soil Survey Assistant
Gerald M. Dunn, ph.d., Assistant Agronomist
Bessie G. Sanborn, Seed Analyst
Walter Lyford, m.s., Soil Surveyor
John F. Gamble, b.s., Graduate Assistant

Bacteriology

Lawrence W. Slanetz, ph.d., Bacteriologist
Edward Katz, ph.d., Assistant Bacteriologist
Fred E. Allen, d.v.m., Veterinarian
Agnes T. Richardson, b.s., Laboratory Assistant
Sherwood Schroeder, b.s., Graduate Assistant in Bacteriology
Joseph Marelli, b.s., Graduate Assistant in Bacteriology
Edmund Wodarski, b.s., Graduate Assistant in Bacteriology

Botany

Albion R. Hodgdon, ph.d., Plant Taxonomist
Stuart Dunn, ph.d., Plant Physiologist
Charlotte G. Nast, ph.d., Associate Cytologist
Avery Rich, ph.d., Plant Pathologist
William MacDonald, m.s., Research Assistant in Botany
John R. Baker, b.s., Graduate Assistant

Dairy

Kenneth S. Morrow, m.s., Dairy Husbandman
Harry Keener, ph.d., Dairy Husbandman
Herbert C. Moore, m.s., Associate Dairy Husbandman
C. H. Boynton, m.s., Associate Dairy Husbandman
Nicholas F. Colovos, m.s., Associate Animal Nutritionist
A. D. Littlehale, Herdsman
Kenneth S. Gibson, b.s., Graduate Assistant

*On leave of absence.

Entomology

James G. Conklin, ph.d., Entomologist
Robert L. Blickle, ph.d., Associate Entomologist
Wallace J. Morse, b.s., Research Chemical Assistant in Entomology

Forestry

Clark L. Stevens, ph.d., Forester
Lewis C. Swain, m.f., Associate Forester
Howard Kriebel, m.f., Assistant Forester

Home Economics

Frances Platts, m.ed., Research Assistant in Home Economics

Horticulture

Albert F. Yeager, ph.d., Horticulturist
Elwyn M. Meader, m.s., Associate Horticulturist
L. Phelps Latimer, ph.d., Associate Horticulturist
William W. Smith, ph.d., Associate Horticulturist
Russell Eggert, m.s., Supt. Horticultural Farm
Edward B. Risley, b.s., Greenhouse Supt.
R. Dee Smith, b.s., Graduate Assistant
Putnam Payne, b.s., Graduate Assistant
S. Z. Berry, b.s., Graduate Assistant

Poultry

Winthrop Skoglund, m.s., Poultry Husbandman
Richard Ringrose, ph.d., Poultry Nutritionist
Fred E. Allen, d.v.m., Veterinarian
Alan C. Corbett, d.v.m., Pathologist
William R. Dunlop, ph.d., Assistant Poultry Pathologist
Walter M. Collins, m.s., Poultry Geneticist
Lawrence M. Potter, b.s., Graduate Assistant in Poultry Husbandry
E. T. Bardwell, R.O.P. Supervisor
C. F. Zoerb, Poultry Inspector
Richard Ford, Senior Laboratory Technician and Research Assistant
Donald S. Cross, Senior Laboratory Technician in Poultry Husbandry
Kathryn Moore, Assistant Laboratory Technician in Poultry Husbandry

Expenditures for the Fiscal Year Ending June 30, 1952

	Hatch	Adams	Purnell	Research and Marketing			
				Bankhead Jones	9(b) 1-2	9(b) 3	Supplementing
Personal Services	$13,044.66	$14,329.06	$52,290.60	$ 9,607.07	$25,778.54	$ 3,741.55	$50,616.92
Travel	23.55	55.68	1,091.54	67.08	358.31	596.12	4,066.25
Transportation of things		6.92	72.88	9.08	18.72		210.71
Communication Service	581.35	61.40	18.00	10.55	23.46	26.80	402.95
Rents and Utility Services	1,100.00		198.00		102.62		
Printing, etc.			7.20	1.25	32.90	86.33	698.50
Other Contractual Services	88.86	20.00	218.37				124.79
Supplies and Materials	148.08	467.33	3,990.90	540.21	1,230.13	1,148.45	7,084.38
Equipment	13.50	59.61	2,112.51	1,128.19	225.00	800.75	1,686.50
Totals	$15,000.00	$15,000.00	$60,000.00	$11,363.43	$27,769.68	$ 6,400.00	$64,891.00

Income for Supplement Expenditures	
State Money Offsetting Federal Funds	$39,133.11
State Money for Station	20,379.45
Research Sales	5,378.44
	$64,891.00

Thelma Brackett